Restricted

SERIAL No. 1348

Preliminary

INSTRUCTION BOOK FOR

Model TBM-11

RADIO TRANSMITTING EQUIPMENT

FREQUENCY RANGE
2,000 to 18,100 Kilocycles

●

Manufactured for U. S. Navy Department
Bureau of Ships
Under
Contract NXsr-38688 Dated September 28, 1943

By

WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY
Radio Division **Baltimore, Maryland**

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INSTRUCTION BOOK

FOR

Model TBM-11

RADIO TRANSMITTING EQUIPMENT

FREQUENCY RANGE

2,000 to 18,100 Kilocycles

TYPE OF EMISSION AND NOMINAL RATINGS

CW Telegraph Transmission
500 Watts
MCW Telegraph Transmission
350 Watts
Voice Transmission
350 Watts

Frequency Range
2,000 to 18,100 Kcs.
With Power Amplifier Disconnected
CW Telegraph Transmission
75 Watts
Frequency Range
2,000 to 9,050 Kcs.

RESTRICTED

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This instruction book is furnished for the information of commissioned, warranted, enlisted and civilian personnel of the Navy whose duties involve design, instruction, operation and installation of radio and sound equipment. The word "RESTRICTED" as applied to this instruction book signifies that this instruction book is to be read only by the above personnel and that the contents of it should not be made known to persons not connected with the Navy.

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SPECIAL NOTE

In the preparation of this preliminary instruction book for Navy Model TBM-11 equipments, certain illustrations as listed below have been omitted. The instruction book in its final form will contain all the missing information.

1. Figures 2-15, 17-28.
2. All Plans for Record Drawings.

Electric Shock

FIRST AID TREATMENT

Safety First—Regard electrical apparatus generally, and especially all current-carrying parts, as dangerous, irrespective of voltage. Exercise great care in handling, and avoid broad contacts such as are made by standing on a metal deck or in water.

Dangerous contact may result through lessened resistance when the skin and clothing are wet with perspiration. Contact with damp metal surfaces—decks, bulkheads, guns, machinery—may allow the current to ground through the moist skin and body.

Electric shock is due to current passing through the body—current actually passing—irrespective of the voltage. A pressure as low as 110 volts has caused death. Current passing through the body in the region of the heart is especially dangerous. In using electric breast drills avoid the possibility of a ground.

Usually electric shock does not kill instantly. Life can often be saved even though breathing has stopped.

1. Free the Victim from the Circuit Immediately. Use a dry non conductor (rubber gloves, clothing, rope, board) to move either the victim or the wire. Beware of using metal or moist material.

Shut off the current.

If necessary to cut a live wire, use an ax or hatchet with a dry wooden handle; turn your face away from the electrical flash.

2. Attend Instantly to the Victim's Breathing. Begin resuscitation at once on the spot. Do not stop to loosen clothing; every moment counts.

Resuscitation by the Prone Pressure Method of Artificial Respiration

GAS ASPHYXIATION—ELECTRIC SHOCK—DROWNING

Waste no time. When the patient is removed from the water, gas, smoke, or electric contact, get to work at once with your own hands. Send for the medical officer or nearest physician.

No reliance should be placed upon any special mechanical apparatus, as it is frequently out of order and often is not available when most needed. The patient's mouth should be cleared of any obstruction such as chewing gum or tobacco, false teeth, or mucus, so that there is no interference with the entrance and escape of air.

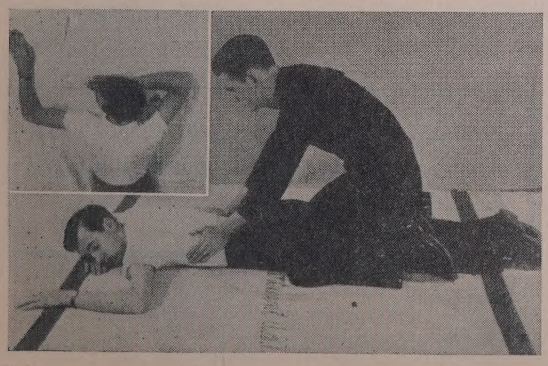

FIG. 1

Position—Lay the patient on his belly, one arm extended directly overhead, the other arm bent at elbow and with the face turned outward and resting on hand or forearm, so that the nose and mouth are free for breathing. (See Inset Fig. 1).

Kneel straddling the patient's thighs with your knees placed at such a distance from the hip bones as will allow you to assume the position shown in Figure 1.

Place the palms of the hands on the small of the back with fingers resting on the ribs, the little finger just touching the lowest rib, with the thumb and fingers in a natural position, and the tips of the fingers just out of sight. (See Fig. 1.)

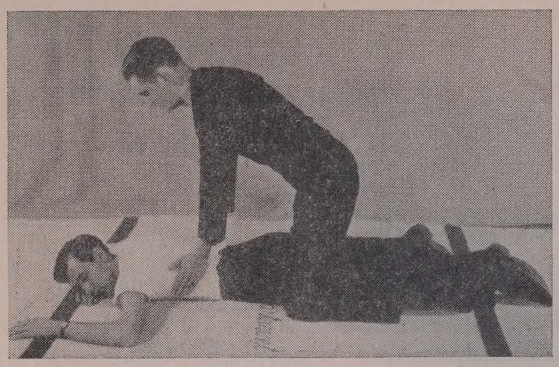

FIG. 2

First Movement—With arms held straight, swing forward slowly, so that the weight of your body is gradually brought to bear upon the patient. The shoulder should be directly over the heel of the hand at the end of the forward swing. (See Fig. 2.) Do not bend your elbows. This operation should take about two seconds.

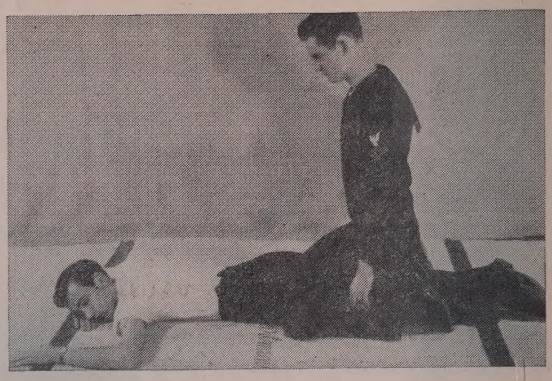

FIG. 3

Second Movement—Now immediately swing backward, so as to remove the pressure completely. (See Fig. 3.)

After two seconds, swing forward again. Thus repeat deliberately twelve to fifteen times a minute the double movement of compression and release, a complete respiration in four or five seconds.

Continue artificial respiration without interruption until natural breathing is restored. Do not get discouraged at the slow results that sometimes happen when resuscitating the apparently drowned. Efforts often have to be continued a long time before signs of life are apparent. Do not discontinue the efforts until certain that all chance is lost. Sometimes, even after several hours' work, recovery takes place.

As soon as this artificial respiration has been started and while it is being continued, an assistant should loosen any tight clothing about the patient's neck, chest, or waist. To keep the patient warm during artificial respiration is most important and it may be necessary to cover him with blankets and work through them, as well as to apply hot-water bottles, hot bricks, etc. Do not give any liquids whatever by mouth until the patient is fully conscious.

To avoid strain on the heart when the patient revives, he should be kept lying down and not allowed to stand or sit up. If the doctor has not arrived by the time the patient has revived, he should be given some stimulant, such as one teaspoonful of aromatic spirits of ammonia in a small glass of water or a hot drink of coffee or tea, etc. Continue to keep the patient warm and at rest.

Resuscitation should be carried on at the nearest possible point to where the patient received his injuries. As a general rule he should not be moved from this point until he is breathing normally of his own volition and then moved only in a lying position. Should it be necessary, due to extreme weather conditions, etc., to move the patient before he is breathing normally, resuscitation should be carried on during the time that he is being moved.

A brief return of natural respiration is not a certain indication for stopping the resuscitation. Not infrequently the patient, after a temporary recovery of respiration, stops breathing again. The patient must be watched, and if natural breathing stops, artificial respiration should be resumed at once.

In carrying out resuscitation it may be necessary to change the operator. This change must be made without losing the rhythm of respiration. The relief operator should kneel behind the one giving the artificial respiration and at the end of the movement, the operator crawls forward while the relief takes his place. By this procedure no confusion results at the time of change of operator, and a regular rhythm is kept up.

Practice in the performance of artificial respiration on a volunteer subject should be obtained by everyone.

Warning!

OPERATION OF THIS EQUIPMENT INVOLVES THE USE OF HIGH VOLTAGES WHICH ARE DANGEROUS TO LIFE. OPERATING PERSONNEL MUST AT ALL TIMES OBSERVE ALL SAFETY REGULATIONS. DO NOT CHANGE TUBES OR MAKE ADJUSTMENTS INSIDE EQUIPMENT WITH HIGH VOLTAGE SUPPLY ON. DO NOT DEPEND UPON DOOR SWITCHES OR INTERLOCKS FOR PROTECTION, BUT ALWAYS SHUT DOWN MOTOR-GENERATORS OR OTHER ASSOCIATED POWER EQUIPMENT AND OPEN MAIN SWITCH IN POWER SUPPLY CIRCUIT. UNDER CERTAIN CONDITIONS, DANGEROUS POTENTIALS MAY EXIST IN CIRCUITS WITH POWER CONTROLS IN THE OFF POSITION DUE TO CHARGES RETAINED BY CAPACITORS, ETC. TO AVOID CASUALTIES, ALWAYS DISCHARGE AND GROUND CIRCUITS PRIOR TO TOUCHING THEM.

Since the use of high voltages which are dangerous to human life is necessary to the successful operation of the radio transmitting equipment covered by these instructions, certain reasonable precautionary measures must be carefully observed by the operating personnel during the adjustment and operation of the equipment.

The major portions of the equipment are within shielding enclosures, provided where necessary with access doors which are generally fitted with safety interlock switches which act to shut off dangerous voltages within the enclosures when the access doors are open.

It should be borne in mind that interlocks are provided only on normal access doors on certain major units, and therefore, side, back or top screens, commutator covers, if removed, will not cause interlocks to function and will thereby allow access to circuits carrying voltages dangerous to human life.

While every practicable safety precaution has been incorporated in this equipment, the following rules must be strictly observed:

KEEP AWAY FROM LIVE CIRCUITS. Under no circumstances should any person be permitted to reach within or in any manner gain access to the enclosure with interlocked gates or doors closed or with power supply line switches to the equipment closed; or to approach or handle any portion of the equipment which is supplied with power, or to connect any apparatus external to the enclosure to circuits within the equipment; or to apply voltages to the equipment for testing purposes while any non-interlocked portion of the shielding or enclosure is removed or open. Wherever feasible in testing circuits, check for continuity and resistance, rather than directly checking voltage at various points.

DON'T SERVICE OR ADJUST ALONE. Under no circumstances should any access gate, door or safety interlock switch be removed, short circuited, or tampered with in any way, nor should reliance be placed upon the interlock switches for removing voltages from the equipment.

THE ATTENTION OF OFFICERS AND OPERATING PERSONNEL IS DIRECTED TO BUREAU OF SHIPS MANUAL OF ENGINEERING INSTRUCTIONS, CHAPTER 31 (MIMEOGRAPHED FORM) OR SUBSEQUENT REVISIONS THEREOF ON THE SUBJECT OF "RADIO-SAFETY PRECAUTIONS TO BE OBSERVED."

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Contractual Guarantee

The equipment including all parts and spare parts, except vacuum tubes, batteries, rubber and material normally consumed in operation, is guaranteed for a period of one year from the date of delivery of the equipment to and acceptance by the Government with the understanding that all such items found to be defective as to material, workmanship or manufacture will be repaired or replaced, f.o.b. any point within the continental limits of the United States designated by the Government, without delay and at no expense to the Government; provided that such guarantee will not obligate the Contractor to make repair or replacement of any such defective items unless the defect appears within the aforementioned period and the Contractor is notified thereof in writing within a reasonable time and the defect is not the result of normal expected shelf life deterioration.

To the extent the equipment, including all parts and spare parts as defined above, is of the Contractor's design or is of a design selected by the Contractor, it is also guaranteed, subject to the foregoing conditions, against defects in design with the understanding that if ten per cent (10%) or more of any such said item, but not less than two of any such item, of the total quantity comprising such item furnished under the contract, are found to be defective as to design, such item will be conclusively presumed to be of defective design and subject to one hundred per cent (100%) correction or replacement by a suitably redesigned item.

All such defective items will be subject to ultimate return to the Contractor. In view of the fact that normal activities of the Naval Service may result in the use of equipment in such remote portions of the world or under such conditions as to preclude the return of the defective items for repair or replacement without jeopardizing the integrity of Naval communications, the exigencies of the Service, therefore, may necessitate expeditious repair of such items in order to prevent extended interruption of communications. In such cases the return of the defective items for examination by the Contractor prior to repair or replacement will not be mandatory. The report of a responsible authority, including details of the conditions surrounding the failure, will be acceptable as a basis for affecting expeditious adjustment under the provisions of this contractual guarantee.

The above one year period will not include any portion of time the equipment fails to perform satisfactorily due to any such defects, and any items repaired or replaced by the Contractor will be guaranteed anew under this provision.

Instructions to Operating Personnel Regarding Report of Failure

Report of failure of any part of this equipment, during its service life, shall be made to the Bureau of Ships in accordance with current instructions. The report shall cover all details of the failure and give the date of installation of the equipment. For procedure in reporting failure see Chapter 31 (mimeographed form) of the Manual of Engineering Instructions, or Bureau of Ships Radio and Sound Bulletin, Number 7, dated July 1, 1942, or superseding instructions.

The blank spaces indicated below should be filled in by ship or station force immediately upon completion of the initial service installation. The date of acceptance by the Navy can be determined by the stamped acceptance plate located on the front panel, immediately below the type plate. These dates are stamped in the sequence of month, day and year.

Contract NXsr-38688, Dated Sept. 28, 1943

Serial Number of Equipment.....

Date of Acceptance by Navy, (Month).....

(Day)..... (Year).....

Date of Delivery to Contract Destination,

(Month).....(Day).....(Year).....

Date of Completion of Installation, (Month).....

(Day)..... (Year).....

Date Placed in Service, (Month).....

(Day)..... (Year).....

All requests or requisitions for replacement material should include complete descriptive data covering the part desired in the following form:

1. Name of part desired.
2. Navy Type Number (if assigned) (including prefix and suffix as applicable).
3. Model designation (including suffix of equipment in which used).
4. Navy Type designation (including prefix and suffix where applicable) of major unit in which part is used.
5. Symbol designation of part.
6. (a) Navy Drawing Number.

   (b) Manufacturer's Drawing Number.
7. Rating or other descriptive data.
8. Commercial designation.

Navy Model TBM-11
Radio Telegraph and Telephone Transmitting Equipment

I. Introduction

A. General, Transmitter

1-1 The Navy Model TBM-11 Radio Telegraph and Telephone Transmitting Equipment has been designed for installation and operation on all types of Naval vessels with exception of certain types of submarines. It consists of three Transmitter Units, Navy Types CAY-52171, 52217, 52218; three Magnetic Controller Units, Navy Types CAY-211231, 211232, 211233; three Motor-Generator Units, Navy Types CAY-21675, 21676, 21677 and a Modulator Unit, Navy Type CAY-50065-A.

1-2 Each of the models is built up around a Transmitter Unit, which is fundamentally the same for all models. The Transmitter Units cover a frequency range of 2000 to 18100 kilocycles with a nominal CW telegraph power output of 500 watts. Provisions are made for disconnecting the final power amplifier to permit low power CW telegraph operation with a nominal power output of 75 watts in the frequency range of 2000 to 9050 kilocycles. The design of the Transmitter Units is based on the Master Oscillator—Intermediate Amplifiers—Power Amplifier principle. The transmitter frequency as controlled by the Master Oscillator is continuously variable in the specified frequency band. The TBM-11 equipment is supplied with a Modulator Unit which permits voice or MCW transmissions modulated up to 100 per cent with a nominal power output of 350 watts.

1-3 Telegraph keying speeds up to 100 words per minute on CW telegraph transmissions and up to 50 words per minute on MCW telegraph transmissions may be utilized. On voice transmissions, the carrier may be controlled manually or by a voice operated relay in the Modulator Unit.

1-4 The TBM-11 Transmitter may be controlled locally, or for CW or MCW transmission, it may be controlled from a remote point by means of a standard Navy Type 23005 4-wire control or a Type 23146 6-wire control. On voice transmissions, the Transmitter may be controlled locally, or from a remote point by means of a Type CRV-23172 or CRV-23211 Radiophone Unit. The Radiophone Units, and the 4- or 6-wire Remote Control Units are not supplied as a part of the TBM-11 equipments. Minor circuit changes easily made at the time of installation permit adapting the Equipment for either 4- or 6-wire control.

1-5 The fundamental difference between the TBM-11 A.C. Equipments and the TBM-11 D.C. Equipments is in the control circuit power for the D.C. equipments. This power is derived from the D.C. supply line, whereas the control circuit power for the A.C. equipments is derived from the A.C. supply line. Thus, the control circuit relays for the TBM-11 D.C. equipments are D.C. operated, and the control circuit relays for the TBM-11 A.C. equipments are A.C. operated. For the TBM-11, 115 volt D.C. equipments, the control circuits are designed for 115 volt, D.C. operation. In the TBM-11, 230 volt D.C. equipments, resistors are inserted in series with the relay circuits to drop the relay operating voltages to their proper voltage.

1-6 The filament circuit power for the TBM-11 D.C. Equipments is taken from slip rings on the D.C. Driving Motor.

1-7 The TBM-11 Radio Telegraph and Telephone Transmitting Equipments have been designed for use with one of the following types of power supplies:

440 Volt, 3 Phase, 60 Cycles Supply
115 Volt, D.C. Supply
230 Volt, D.C. Supply

B. General, Modulator

1-8 The Type CAY-50065-A Modulator Unit is designed for installation and operation with several different transmitters. It is composed of the

apparatus necessary for taking power from a motor-generator set and modulating the transmitter by either tone or voice.

1-9 The modulator is essentially a three stage push-pull amplifier. Provision is made for transmission by CW, MCW, or VOICE. Telegraph keying speeds up to 100 words per minute may be utilized on CW and 50 words per minute on MCW operation. The design of the modulator is such that when supplied with speech input at a 6 Milliwatt level from a 600 Ohm source, it will be capable of effecting 100% plate modulation of the transmitter with an audio frequency distortion of less than 10%. The modulator is a single self-contained unit, complementary to the transmitter unit, and similar to it in general construction and appearance.

1-10 The Type CAY-50065-A Modulator Unit consists of the following items:

TYPE CAY-50065-A MODULATOR

Height — 72″
Width — 18″
Depth — 24″
Weight — 380 lbs.

Vacuum Tubes

The tubes used in the modulator are as follows:

2 Type—6D6 (input amplifier)
2 Type—807 (interstage amplifier)
1 Type—807 (voice relay tube)
2 Type—803 (modulator)
1 Type—25Z5 (compressor-limiter)
1 Type—1616 (modulation limiter)

Spare Parts

Spare parts for Modulator Unit (see Spare Parts List for complete data) are shipped in a box having the following dimensions:

Height — 12¾″
Width — 19⅜″
Depth — 13¾″
Weight — 43 lbs.

1-11 All necessary operating controls are located on the front panel, and are electrically "dead."

The gain of the modulator is approximately 60 Db. Approximately 400 watts are available for modulation purposes from the final amplifier, over the audio frequency range of 100 to 5000 cycles. The same output power is available for MCW operation. Modulation frequency in this case is 800 cycles, and is obtained from an audio oscillator in the modulator unit.

Power Supply: The modulators have been designed for use on any one of the following types of power supply:

Modulator Type CAY-50065-A

115 Volts D.C. ±10%
230 Volts D.C. ±10%
220 Volts, 3 Phase, 60 Cycles
440 Volts, 3 Phase, 60 Cycles
220 Volts, 1 Phase, 60 Cycles

C. General, Power Equipment

1-12 The power equipment used with TBM-11 units, is designed to convert the available supply line power to suitable D.C. power for the operation of the Transmitter Unit, and Modulator Unit when used.

1-13 For convenience, a table of the various power equipment used is given below:

	Used as part of
Motor Generator Type CAY-21675	TBM-11—115 volt D.C. Equipment
Motor Generator Type CAY-21676	TBM-11—230 volt D.C. Equipment
Motor Generator Type CAY-21677	TBM-11—440/3/60 cycle Equip.
Magnetic Controller Type CAY-211231	TBM-11—115 volt D.C. Equipment
Magnetic Controller Type CAY-211232	TBM-11—230 volt D.C. Equipment
Magnetic Controller Type CAY-211233	TBM-11—440/3/60 cycle Equip.

1-14 The motor-generator units supplied as a part of Model TBM-11 Transmitting Equipments are of the three unit, six-bearing type. All three units are mounted on a cast steel bedplate in such a manner that any unit may be removed from the bedplate without necessitating the displacement of any other unit. The units are coupled together with flexible couplings and are fitted with self aligning ball bearings. Each motor-generator unit consists of two D.C. generators and a driving motor. The D.C. generators are the same for all equipments. The driving motors differ according to the various supply line voltages and frequencies for which the transmitting equipments are designed.

1-15 The magnetic controller units supplied as a part of Model TBM-11 Transmitting Equipments are of the remote controlled drip proof, protected magnetic contactor type. The magnetic controller units differ according to the various supply line voltages and frequencies for which the transmitting equipments are designed. All of the contactors, relays, and resistors associated with the controller are assembled on an insulated panel and mounted in a sheet steel box.

1-16 Power required from the supply line for locked key operation is 5.7 Kw. The maximum allowable supply line variation in voltage for both A.C. and D.C. equipments is ±10%. In the case of A.C. equipments, the allowable supply line frequency variation is ±5%, and the allowable supply line combined variation of frequency and voltage is ±10%.

D. Weights and Dimensions

1-17 A complete equipment for any one type of power supply consists of the following component units:

440 VOLT, 3 PHASE, 60 CYCLE OPERATION

Radio Transmitter Unit, Type CAY-52171

Height — 72″
Width — 32″
Depth — 24″
Weight — 789 lbs.

Modulator Unit, Type CAY-50065-A

Height — 72″
Width — 18″
Depth — 24″
Weight — 380 lbs.

Motor-Generator Unit, Type CAY-21677
Consisting of:
Induction Motor, Type CAY-21682
High Voltage D.C. Generator, Type CAY-21680
Low Voltage D.C. Generator, Type CAY-21679

Height — 20⅜″
Length — 74 21/32″
Width — 20½″
Weight — 1100 lbs.

Magnetic Controller, Type CAY-211233

Height — 11 9/32″
Width — 8 7/32″
Depth — 6¾″
Weight — 18 lbs.

Complete set of Vacuum Tubes Consisting of:

Installed	Spares	Type	Weight Net Each
Transmitter Unit			
3	3	860	7¼ oz.
1	1	861	10¼ oz.
			Total weight 2.0 lbs.
Modulator Unit			
2	2	6D6	1¾ oz.
3	3	807	2¼ oz.
2	2	803	11¼ oz.
1	1	25Z5	3 oz.
1	1	1616	3¼ oz.
			Total Weight 2.5 lbs.

Spare Parts consisting of:

Spare Parts Box #1 containing Transmitter Unit Spare Parts

Height — 15¾″
Width — 25⅜″
Depth — 16¾″
Weight — 120 lbs.

Spare Parts Box #2 containing miscellaneous Power Equipment Spare Parts

Height — 6¾″
Width — 26″
Length — 30½″
Weight — 121 lbs.

Spare Parts Box #3 containing armature for Navy Type CAY-21680 Generator

Height — 8½″
Width — 10″
Length — 30″
Weight — 55 lbs.

Spare Parts Box #4 containing armature for Navy Type CAY-21679 Generator

Height — 6¾″
Width — 8½″
Length — 24½″
Weight — 110 lbs.

Spare Parts Box #5 containing Modulator Unit Spare Parts

Height — 12¾″
Width — 19⅜″
Depth — 13¾″
Weight — 50 lbs.

Total Weight of Equipment 2747.5 lbs.

115 VOLT D.C. SUPPLY

Radio Transmitter Unit, Type CAY-52217

Height — 72″
Width — 32″
Depth — 24″
Weight — 789 lbs.

Modulator Unit, Type CAY-50065-A

Height — 72″
Width — 18″
Depth — 24″
Weight — 380 lbs.

Motor Generator Unit, Type CAY-21675, consisting of:
D.C. Motor, Type CAY-21678
High Voltage D.C. Generator, Type CAY-21680
Low Voltage D.C. Generator, Type CAY-21679

Height — 20¼″
Length — 78 13/16″
Width — 20¼″
Weight — 1150 lbs.

Magnetic Controller, Type CAY-211231

Height — 20½″
Width — 15″
Depth — 10⅜″
Weight — 76 lbs.

Complete Set of Vacuum Tubes consisting of:

Installed	Spares	Type	Weight Net Each
Transmitter Unit			
3	3	860	7¼ oz.
1	1	861	10¼ oz.
			Total Weight 2 lbs.
Modulator Unit			
2	2	6D6	1¾ oz.
3	3	807	2¼ oz.
2	2	803	11¼ oz.
1	1	25Z5	3 oz.
1	1	1616	3¼ oz.
			Total Weight 2.5 lbs.

Spare Parts consisting of:

Spare Parts Box #1 containing Transmitter Unit Spare Parts

Height — 15¾"
Width — 25⅜"
Depth — 16¾"
Weight — 120 lbs.

Spare Parts Box #2 containing Power Equipment Spare Parts

Height — 6¾"
Width — 26"
Length — 30½"
Weight — 121 lbs.

Spare Parts Box #3 containing armature for Navy Type CAY-21680 Generator

Height — 8½"
Width — 10"
Length — 30"
Weight — 55 lbs.

Spare Parts Box #4 containing armature for Navy Type CAY-21679 Generator

Height — 6¾"
Width — 8½"
Length — 24½"
Weight — 110 lbs.

Spare Parts Box #5 containing Modulator Unit Spare Parts

Height — 12¾"
Width — 19⅜"
Depth — 13¾"
Weight — 50 lbs.

Spare Parts Box #6 containing armature for Navy Type CAY-21675 D.C. Motor

Height — 10¼"
Width — 12¾"
Length — 32"
Weight — 105 lbs.

Total Weight of Equipment 2960.5 lbs.

230 VOLT, D.C. SUPPLY

Radio Transmitter Unit, Type CAY-52218

Height — 72"
Width — 32"
Depth — 24"
Weight — 789 lbs.

Modulator Unit, Type CAY-50065-A

Height — 72"
Width — 18"
Depth — 24"
Weight — 380 lbs.

Motor Generator Unit, Type CAY-21676 consisting of:

D.C. Motor, Type CAY-21681
High Voltage D.C. Generator Type CAY-21680
Low Voltage D.C. Generator Type CAY-21679

Height — 20¼"
Length — 78$^{13}/_{16}$"
Width — 20¼"
Weight — 1150 lbs.

Magnetic Controller, Type CAY-211232

Height — 20½"
Width — 15"
Depth — 10⅜"
Weight — 76 lbs.

Complete Set of Vacuum Tubes consisting of:

Installed	Spares	Type	Weight Net Each
Transmitter Unit			
3	3	860	7¼ oz.
1	1	861	10¼ oz.
			Total Weight 2 lbs.
Modulator Unit			
2	2	6D6	1¾ oz.
3	3	807	2¼ oz.
2	2	803	11¼ oz.
1	1	25Z5	3 oz.
1	1	1616	3¼ oz.
			Total Weight 2.5 lbs.

Spare Parts consisting of:

Spare Parts Box #1 containing Transmitter Unit Spare Parts

Height — 15¾"
Width — 25⅜"
Depth — 16¾"
Weight — 120 lbs.

Spare Parts Box #2 containing Power Equipment Spare Parts

Height — 6¾"
Width — 26"
Length — 30½"
Weight — 121 lbs.

Spare Parts Box #3 containing armature for Navy Type CAY-21680 Generator.

Height — 8½"
Width — 10"
Length — 30"
Weight — 55 lbs.

Spare Parts Box #4 containing armature for Navy Type CAY-21679 Generator

Height — 6¾"
Width — 8½"
Length — 24½"
Weight — 110 lbs.

Spare Parts Box #5 containing Modulator Unit Spare Parts

Height — 12¾"
Width — 19⅜"
Depth — 13¾"
Weight — 50 lbs.

Spare Parts Box #6 containing armature for Navy Type CAY-21681 D.C. Motor

Height — 10¼"
Width — 12¾"
Length — 32"
Weight — 105 lbs.

Total Weight of Equipment 2960.5 lbs.

II. Description

TRANSMITTER

A. General

2-1 The Navy Model TBM-11 unit utilizes either of three different types of Transmitter Units which are listed below:

Type CAY-52171, a part of Model TBM-11, 440 Volts, 3 Phase, 60 Cycle Transmitting Equipments.

Type CAY-52217, a part of Model TBM-11, 115 V. D.C. Transmitting Equipments.

Type CAY-52218, a part of Model TBM-11, 230 V. D.C. Transmitting Equipments.

2-2 The High Frequency Transmitter Units, Type CAY-52171, Type CAY-52217 and Type CAY-52218 are suitable for use with any antenna that has characteristics which fall within the following limits:

Maximum antenna trunk length	35 ft.
Minimum antenna trunk length	No trunk
Diameter of trunk, if used	8 to 12 in.
Maximum distance of transmitter from inner end of trunk or entering insulator	20 ft.
Minimum distance of transmitter from inner end of trunk or entering insulator	2 ft.
Maximum length of antenna outside trunk	80 ft.
Minimum length of antenna outside trunk, sufficient to permit efficient radiation of energy	

2-3 Under these conditions, the High Frequency Transmitter Units will deliver the power given in the following table, using a Navy Type 861 tube as the final amplifier.

Freq. Kcs.	Antenna Cap. mmfd.	Antenna Res. Ohms	Power Output Watts CW
2000	*	*	500
3000	*	*	500
3500	*	*	475
4000	*	*	475
4500	*	*	450
6000	*	*	450
7500	*	*	400
9050	*	*	375
12000	*	*	360
16000	*	*	325
18100	*	*	300

*500 Watt, 110 V. Mazda "C" Lamp, practically non-reactive resistance between antenna terminal and ground.

2-4 In the equipment schematic diagrams and the control schematic diagrams of the TBM-11 equipments, when a circuit part is marked with *two or more* circuit symbols, those symbols refer to parts which vary due to different voltage or frequency ratings, but which perform the same function in a circuit. In the following text, reference will be made to all of the circuit symbols designating a circuit part. These references will be made in the order shown in the table listed below. The symbol coding as it appears on the diagrams and in the table below will not be given in the text. A circuit part which bears only one circuit symbol is used in a given model independently of the power supply rating of the model.

2-5

Unit	Reference Order	Part Used with Unit Rated at:	Sample Symbol
Transmitter Units	1	440/3/60	T-1
	2	115 Volt D.C.	R-56
	3	230 Volt D.C.	R-57
	4	Common to both 115 & 230 V. D.C.	T-1
Magnetic Controller Units	1	440/3/60	K-861
	2	115 Volt D.C.	K-841
	3	230 Volt D.C.	K-851
	4	Common to both 115 & 230 V. D.C:	K-841

2-6 In order to follow the description for any one Transmitter Unit, refer to the drawings listed below.

	TBM-11 A.C.		TBM-11 D.C.	
	Fig.	Dwg.	Fig.	Dwg.
Outline & Mtg. Dimen.	35	T-7611719	35	T-7611719
Schematic Diagram	29	W-7300717	30	W-7300716
Wiring Diagram	33	W-7300447	32	W-7300446

2-7 The circuits in the Radio Transmitter Unit include a self-excited Master Oscillator, using a Type 860 tube, a First Intermediate Amplifier using a Type 860 tube, a Second Intermediate Amplifier using a Type 860 tube, a Power Amplifier using a Type 861 tube and an Antenna Tuning System arranged for either current or voltage feed to the antenna. Two tube access doors are provided, one

for the master oscillator tube and the other for the amplifier tubes. One access door is provided for the terminal board and relays. All these doors are provided with interlocks which will remove all power (except line voltage and master oscillator heater system power) from the Radio Transmitter Unit if any door is opened.

2-8 For descriptive convenience, the complete Radio Transmitter Unit may be divided into the following seven sections:

B. Terminal Board and Relay Section
C. Master Oscillator
D. First Intermediate Amplifier
E. Second Intermediate Amplifier
F. Power Amplifier
G. Antenna Tuning and Coupling Section
H. Power and Control Switches

2-9 Each of these sections will be described in detail.

B. Terminal Board and Relay Section

2-10 The terminal board and relay panel is located at the bottom of the Radio Transmitter Unit and is accessible by opening an access door in the lower front panel. This door is suitably interlocked with the control circuits and held in place by two door latches. All external control and power wiring, with the exception of the antenna lead, is connected to the terminal board. Antenna connection is made at the top of the unit and is accessible through a hole located in the top shield. For TBM-11 Transmitter Units, Type CAY-52171, Type CAY-52217, and Type CAY-52218, see Outline Drawing Fig. 35, Dwg. T-7611719. Mounted on the terminal board and relay panel for Types CAY-52171, CAY-52217 and CAY-52218, see Fig. 3, are the H.V. Overload Relay K-5, M.O. Plate Overload Relay K-7, Compensator Relay K-2, Starting Contactor K-14, K-4, and Field Contactor K-19, K-9 used in the keying control circuits. Behind the terminal board panel are mounted the Filament Transformer T-1 and, in the case of A.C. Equipments, Step-Down Transformers T-14, T-15, and M.O. Filament Transformer T-12. Also mounted behind the terminal board are the Keying Filter Choke L-16, M.O. Plate and Screen Voltage Filter Capacitor C-47, Grid Bias Filter Capacitor C-48, 2000 Volt Filter Capacitor C-58, H.V. Filter Capacitor C-65, Bias Potentiometer Resistors R-1, R-19, R-21 and R-28, M.O. Screen Grid Resistor R-2, M.O. Plate Resistor R-3, H.V. Potentiometer Resistors R-15, R-16, R-45, R-46, R-47, and R-48.

C. Master Oscillator

2-11 On the left side of the transmitter is the master oscillator, which is mounted within the transmitter as a separate unit. It is 35½ inches high, 22 inches deep, and 12½ inches wide. This complete unit may be removed from the transmitter for servicing. The master oscillator unit is mounted with springs and snubbed by means of sponge rubber cushions in such a manner that very little vibration is transmitted from the transmitter frame to the M.O. unit.

2-12 The master oscillator uses a Type 860 tube in an electron-coupled circuit which has its tank circuit inductance and capacitance mounted in a temperature controlled compartment in the upper part of the master oscillator unit. This compartment requires approximately three hours to come up to temperature, after which it is automatically held at an approximate constant temperature of 60 degrees C. The temperature is controlled by means of mercury-type Thermostat S-13 set for 60 degrees C. and Thermostat Relay K-8 or K-20. Relay K-20 is used in the D.C. Transmitter Units and is operated from potentiometer Resistor R-56, R-57 which is connected across the 115 or 230 volt D.C. blower motor supply. Relay K-8 is used in the A.C. units and is connected across potentiometer Resistor R-27 which is placed across the 115 volt, 60 cycle control circuit power supply. Temperature protection Switch S-11, in the forme of a "Westinghouse Watchman" is connected in series with thermostat relay contacts K-8B, K-20B and disconnects the heater circuit in case the temperature should rise to 70 degrees C. due to failure of any temperature controlling device. A spark filter, consisting of C-60 and R-49 and R-58, is connected across S-11 and thermostat relay contacts K-8B, K-20B. A spark filter, consisting of R-50, is connected across the contacts of S-13. For Transmitter Type CAY-52171, see Fig. 29, Dwg. W-7300717. For Transmitter Units Type CAY-52217 and CAY-52218, see Fig. 30, Dwg. W-7300716.

2-13 Blower Motor (B-11, B-1), located directly above the master oscillator unit, circulates the air constantly within the master oscillator tank circuit compartment. It maintains all frequency determining parts of the circuit at a practically constant temperature. B-11, a 115 volt, 60 cycle motor, is used in the Type CAY-52171 Transmitter Unit and is operated directly from the control circuit supply voltage. B-1, a 115 volt, D.C. motor, is used in the D.C. Transmitter Units. In the 115 volt D.C. Trans-

mitter Unit, Type CAY-52217, B-1 is operated from the 115 volt, D.C. supply voltage. In all the above mentioned Transmitters, a dummy resistor having zero resistance has replaced Resistor R-7. In the 230 volt D.C. Type CAY-52218 Transmitter Unit, Resistor R-7 is used to drop the line voltage to 115 volts for operation of Blower Motor B-1.

2-14 Also located in the constant temperature box is Compensating Capacitor C-62. This capacitors consists of a bi-metallic device which is connected into the circuit in such a manner that it compensates for the effect of variable tube capacity due to the tube heating when the Master Oscillator tube is in operation. The bi-metal is actuated by current from Transformer T-3, which is supplied with power through Relay K-2B contact. *Do Not Make Any Adjustment On Compensation Capacitor C-62. This Capacitor Has Been Set Correctly At The Factory And No Adjustment Is Needed.*

2-15 The cover for the master oscillator heat compartment is fitted with a paper gasket. This has been done to provide good contact at definitely known points only; namely, at the screws; *and to eliminate unknown contact elsewhere.*

2-16 Thermostat Relay K-8, K-20 and Thermostat Relay Resistors R-27, R-56, R-57 are located directly above the master oscillator unit.

2-17 The lower right-hand compartment of the master oscillator unit contains the *master oscillator output doubler circuit, which is always tuned to double the master oscillator frequency.*

2-18 The electron-coupled circuit, as used in the master oscillator, is shown complete in the schematic circuit diagrams. Referring to these diagrams, the tuned circuit consists of the variable tapped master oscillator tank Capacitors, C-1, C-2, C-3 and C-56. This circuit covers the frequency band of 1,000 to 2,262.5 Kcs. Tuning is accomplished by the selection of proper coil taps by MASTER OSCILLATOR RANGE SWITCH S-1 (Control A) and by moving a copper cylinder inside the coil (Control B). In order to avoid neutralizing the master oscillator plate circuit, the screen grid is tied to ground through by-pass Capacitor C-6. The tube filament is operated at a radio frequency potential above ground. The master oscillator Filament Choke L-2 prevents the radio frequency filament potential from leaking off to ground through M.O. Filament Transformer T-12. Capacitors C-8 and C-9 by-pass the filament and provide a mid-tap for connecting the filaments to the tank circuit. Resistor R-2 drops the potential on the screen grid, which is used as an anode in this circuit, to approximately 300 volts. M.O. plate power is supplied to the tube through M.O. plate Resistor R-3 and the radio frequency master oscillator plate Choke L-4. Resistor R-3 reduces the 1,000 volt plate supply to approximately 700 volts. For this particular application of the Type 860 tube, values of *approximately 300 volts for the screen grid and 700 volts for the plate are the optimum operating voltages* necessary to obtain maximum frequency stability regardless of variations in supply voltage. Choke L-4 prevents the radio frequency plate power from leaking to ground through Resistor R-3 and the 1,000 volt supply. The doubler circuit coupling Capacitor C-13 blocks off D.C. plate potential and also couples the master oscillator to the doubler circuit. This circuit consists of the variable DOUBLER CIRCUIT TUNING Capacitor C-14 (Control C) and the Doubler Tank Coil L-3. It is always tuned to the second harmonic of the oscillator, i.e., tuned to frequencies in the 2000 to 4525 Kcs. band. Therefore, grid excitation is provided for the first intermediate amplifier through Capacitor C-15. A stop has been provided at the high frequency end of the MASTER OSCILLATOR TUNING (Control B), which is effective on the eight ranges of the MASTER OSCILLATOR RANGE SWITCH (Control A), so that proper frequency range and overlap is obtained. This stop is set at such a position that a maximum dial setting of 5000 divisions is obtained. The stop is attached to the threaded shaft on which the copper cylinder in the M.O. Tank Coil L-1 travels. It determines the limit of clockwise rotation of MASTER OSCILLATOR TUNING (Control B).

2-19 The following is a brief explanation of the electron coupled oscillator circuit. In order to more easily explain the circuit, reference is made first to the standard Colpitts oscillator circuit shown in Fig. 49, Dwg. P-7705422. In this circuit, Coil L-1 and Capacitors C-1 and C-2 form the tank circuit, which operates at a frequency "f".

2-20 M.O. tank Capacitors C-1 and C-2 are of such a value as to give the correct voltage distribution to the plate and grid for correct operation. Generally, C-1 is approximately four times as large as C-2. C-3 is the grid blocking capacitor. The grid receives its bias by action of Grid Leak R-1. C-4 is the plate blocking capacitor. The high voltage is fed to the plate through radio frequency Choke RFC-1. Output frequency is the same as that of the tank circuit "f".

2-21 Referring to the electron coupled oscillator oscillator circuit shown in Fig. 49, Dwg. P-7705422, it can be seen that the circuit is very similar to the Colpitts circuit using a three element tube. The exception is that the screen grid of the four element tube takes the place of the plate. The tank circuit is again composed of Inductance L-1 and Capacitors C-1 and C-2, and operates at a frequency "f". In order to obtain the shielding action of the screen grid, the screen grid end of the tank circuit is grounded instead of the filament. This operates the filament at radio frequency potential, and necessistates the use of radio frequency Chokes RFC-2 and RFC-3 in the filament leads to Transformer T-1. It should be noted that Capacitors C-1 and C-2 have been interchanged, placing the high radio frequency potential on the grid instead of the screen grid. This causes the output frequency to be high in harmonic content, which is an advantage which will be shown later.

2-22 The plate of the tube is connected through to the output circuit in the same manner as in the Colpitts circuit. The plate, however, does not receive its energy from the oscillator circuit in the usual manner of capacity-coupling or direct connection. The grounded screen prevents capacity coupling. Since the electron flow to the plate must pass through the screen grid, the screen modulates the plate current at radio frequency "f". The desired A.C. in the plate circuit is then built up across the impedance offered by Choke RFC-1. This method of coupling is highly advantageous since any change made in the output circuit reflects only very slightly on the tank circuit and does not shift the frequency. This allows a doubling circuit composed of L-2 and C-7 to be connected to the plate and operated at twice the frequency of the main tank circuit or "2f". This further reduces the effect of any variation in the circuits attached to the output.

2-23 It has been found with the electron coupled circuit that if screen grid voltage is held constant, and plate voltage is varied, the frequency decreases as the plate voltage is increased. Conversely, if plate voltage is held constant, and screen grid voltage is varied, the frequency increases as the voltage is increased. The two curves can be made approximately equal and opposite by proper proportioning of the circuit and operating voltages. Then, if the screen grid and plate are connected to the same potential, and series resistors used to obtain the correct operating voltages, any change in the supply voltage causes only a very small amount of shift in the output frequency. The resistors which accomplish this are R-2 and R-3.

D. First Intermediate Amplifier

2-24 The first intermediate amplifier is located in the lower right-hand compartment of the transmitter. It is used to prevent reaction on the master oscillator by the second, intermediate, and power amplifiers. For transmitter output frequencies of 2000 and 4000 Kcs., the first intermediate amplifier is operated as a fundamental or straight through amplifier at the frequency of the M.O. doubler circuit (L-3, C-14, Control C). For the transmitter output range of 4000 to 9050 Kcs., the first intermediate amplifier (L-7, C-21, Control D) is operated as a frequency multiplier to double the output frequency of the master oscillator doubler circuit (i.e., functioning at four times the frequency of the M.O. tank circuit). When the first intermediate amplifier is operating as a frequency doubler, the FREQUENCY RANGE Switch S-2E (Control L) is closed, shorting out approximately half the turns in Tank Coil L-7. The Type 860 tube, used in this stage, obtains its grid excitation from the tuned output circuits of the master oscillator doubler circuit through Capacitor C-15. Grid Choke L-6 offers a high impedance path for the radio frequency grid voltage to ground. At the same time, it allows a blocking bias to be applied to the tube grid from bias Potentiometer R-19 and R-21. Capacitor C-16 protects the potentiometer and bias circuit from any transient radio frequency potential. Resistor R-25 provides an operating bias in addition to that normally supplied from bias Potentiometers R-19, R-21 and R-28. The tuned plate circuit consists of the 1ST INTERMEDIATE AMPLIFIER TUNING Capacitor C-21 (Control D) and tank Coil L-7. Filament by-pass Capacitors C-17 and C-18 by-pass the filament and effectively ground it for R.F. Capacitor C-20 grounds one end of the plate tank circuit for R.F. The first intermediate amplifier R. F. Plate Choke L-5 is used to prevent any radio frequency energy from getting back to the plate voltage supply.

2-25 Screen grid potential for this stage is obtained from a potentiometer consisting of Resistors R-15, R-16, R-45, R-46, R-47, and R-48 which are connected across the terminals of the 2000 volt supply. Screen Resistor R-8, in series with the screen, further reduces the screen grid potential by the amount of screen grid current flowing through it. Operation is also improved by providing proper

screen grid voltage. The screen grid is effectively grounded for radio frequencies by the first intermediate amplifier screen grounding Capacitor C-19.

E. Second Intermediate Amplifier

2-26 The second intermediate amplifier is located immediately above the first intermediate amplifier. For transmitter output frequencies of 2000 to 9050 Kcs., the amplifier is operated as a fundamental or straight through amplifier. This amplifier may also be used as a final amplier over the range by operation of HIGH-LOW POWER Switch S-3, S-4 and S-5. This switch disconnects the 500 watt power amplifier tube and transfers the antenna circuit to the second intermediate amplifier. When the second intermediate amplifier is functioning as the final amplifier, an output of approximately 75 watts is obtained. For output frequencies of 9050 to 18100 Kcs., the second intermediate amplifier is operated as a frequency doubler and excites the power amplifier.

2-27 R.F. Grid Choke L-8 offers a high impedance path for the radio frequency grid voltage to ground. At the same time, it allows a blocking bias to be applied to the tube grid from bias Potentiometers R-19, R-21, and R-28. Capacitor C-25 protects the potentiometer and bias circuit from any transient radio frequency potential.

2-28 The tuned plate circuit of the second intermediate amplifier consists of a continuously variable second intermediate amplifier Tank Coil L-9, a variable SECOND INTERMEDIATE AMPLIFIER TUNING Capacitor C-29 (Control E) and a fixed mica second intermediate amplifier tank Capacitor C-53. The mica capacitor is placed in the circuit by means of FREQUENCY RANGE Switch S-2D for the transmitter output of 2000 to 4000 Kcs.

F. Power Amplifier

2-29 The power amplifier is located in the upper right-hand compartment of the transmitter and is similar in construction to the second intermediate amplifier except that a Type 861 tube is used. Switches are provided for disconnecting the filament, grid, screen grid, and plate potentials from the tube when the transmitter is operating on low power (75 watt output). The power amplifier operates as a fundamental or straight through amplifier over the entire frequency range of 2000 to 18100 Kcs. For the frequency range of 2000 to 4000 Kcs., the FREQUENCY RANGE Switch S-2B inserts a fixed P.A. Tank Capacitor C-54 in parallel with POWER AMPLIFIER TUNING Capacitor C-39 in the power amplifier tank circuit. See Switches S-3, S-4 and S-5 on the schematic circuit diagram. For the Type CAY-52171 Transmitter, see Fig. 29, Dwg. W-7300717. For Transmitters, Types CAY-52217 and CAY-52218 refer to Fig. 30, Dwg. W-7300716.

G. Antenna Tuning and Coupling Section

2-30 The antenna tuning circuits and keying Relay K-1 occupy the entire top compartment of the transmitter. The antenna tuning system is made up of Capacitor C-41, Inductance L-13, ANTENNA CURRENT-VOLTAGE FEED SWITCH S-6, ANTENNA TUNING CAPACITOR C-42, and ANTENNA CURRENT Ammeter M-1.

2-31 ANTENNA TUNING CAPACITOR C-42 is variable and is operated in parallel with the variable ANTENNA TUNING INDUCTANCE L-13 for VOLTAGE FEED and in series with L-13 for CURRENT FEED to the antenna. The transmitter antenna terminal is located at the top of the unit and is accessible through a hole in the top shield.

2-32 Keying Relay K-1 is located in this compartment. Contacts K-1C key the master oscillator by opening the ground side of the high voltage plate supply to the Type 860 tube. Contacts K-1C are shunted by arc suppressor Capacitor C-45 in series with arc suppressor Resistor R-4. This combination is connected in series with Choke L-16 to reduce arcing and resultant key clicks to a minimum. The amplifier stages are operated Class C and, therefore, supplied with a bias voltage of sufficient value to block the tubes when no excitation is supplied by the master oscillator. Contacts K-1D of the keying relay are connected to the terminal board and are used for keying an audio oscillator located in the Type CAY-50065-A Modulator Unit. Contacts K-1B and K-1E of the keying relay are wired to the terminal board for use in operation of associated receiver attenuator relays. Contact K-1B is a normal "make" contact and may be used for energizing a receiver attenuator relay when the transmitter key is closed. Contact K-1E is a normal "break" contact and may be used to control a receiver attenuator relay which must be de-energized when the transmitter key is closed. When these contacts are used in connection with receiver attenuator relays, suitable spark suppression circuits (capacitor and resistor combination) should be incorporated externally to the transmitter to completely eliminate sparking at the relay contacts for the specific load they are handling.

2-33 The coil of compensator Relay K-2 is energized whenever the coil of Relay K-1 is energized. Closing of the contacts of Relay K-2 controls power to Capacitor C-62. This capacitor maintains frequency stability of the M.O. for key OPEN or CLOSED conditions.

H. Power and Control Switches

2-34 The control switches and the indicating lamps are located on a panel directly above the master oscillator unit. The control switches are as follows: TEST Key S-10, MASTER OSCILLATOR FILAMENT STAND-BY POWER Switch S-27 (A.C. equipment only), START-STOP Switch S-8 or S-17 (4- or 6- wire control switch), LOCAL-REMOTE Switch S-7, TUNING-STEP 1, STEP 2-OPERATE Switch S-9 and EMERGENCY SWITCH S-12.

2-35 TEST Key S-10 is of the two section toggle type and accomplishes the same function as the remote telegraph key. It will key the transmitter when it is manually placed in the UP or DOWN position. When it is placed to the UP position, it automatically locks in position, but when placed to the DOWN position, it will reset to the MID or OFF position as soon as it is released. S-10 is used to excite Keying Relay K-1. For the Type CAY-52171 Transmitter, see Fig. 29, Dwg. W-7300717. For the Transmitters, Types CAY-52217 and CAY-52218 refer to Fig. 30, Dwg. W-7300716.

2-36 The M.O. FILAMENT STAND-BY POWER Switch S-27 (used only on A.C. equipments) shunts the "C" contacts of starting Contactor K-14 connected in the primary supply of Transformer T-12. By means of Switch S-27, M.O. filament Transformer T-12 may be connected to supply filament power to the master oscillator tube at all times. Resistor R-44 in series with S-27 reduces the filament voltage to the proper value during stand-by periods. On D.C. equipments, where the filament power is obtained from the motor-generator unit, this M.O. filament stand-by feature is not provided. It would be necessary to have the motor-generator running continually in order to keep the M.O. filaments lighted at all times. As this procedure is not practical, the M.O. FILAMENT STAND-BY SWITCH S-27 and STAND-BY RESISTOR R-44 are not used.

2-37 START-STOP Switch S-8 or S-17 is used to START or STOP the motor-generator unit supplying power to the transmitter. Two START-STOP Switches (S-8 and S-17) are provided. These two switches allow the use of either a 4- or 6-wire remote control system with the equipment. Switch S-8 is to be used with a 4-wire control system and S-17 with a 6-wire control system. All transmitter units are wired for 4-wire control at the factory. Minor circuit changes, easily made at the time of installation, permit the use of this equipment with either 4- or 6-wire control. See Paragraph 3-23 for information. In the 4-wire control system, one side of the key circuit and one side of the start-stop switch circuit are common. The type of switch used for starting and stopping the equipment is a double pole single throw toggle switch type (S-8), connected in series with the starting Contactor K-14, K-4 solenoid. With Switch S-8 closed, the equipment will be in operation and will continue to operate until the starting contactor solenoid circuit is broken by opening of S-8. In the 6-wire control system, the starting circuit and the keying circuit are entirely separate and the start-stop circuit is of the momentary push-button type more commonly used for control of large electrical equipment. START-STOP Switch S-17, used for this system, consists of two normally open switches, S-17A and S-17B, which control the operation of the equipment over three control wires as follows: In this system, starting Contactor K-14, K-4 must operate with an impedance L-20 (in the case of A.C. equipments), R-35 (in the case of 115 volt D.C. equipments), and R-34 (in the case of 230 volt D.C. equipments) in series with its operating solenoid. The START portion S-17A is connected in series with starting contactor Solenoid K-14A, K-4A. Momentarily closing Switch S-17A closes Contactor K-14, K-4. Contact K-14B, K-4B immediately interlocks or parallels S-17A so that upon releasing S-17A, the solenoid circuit remains closed and the equipment stays in running condition. To stop the equipment, starting Contactor K-14, K-4 solenoid is shorted by the STOP portion S-17B of START-STOP Switch S-17, thereby causing the contactor to open. Contact K-14B, K-4B immediately breaks the holding circuit of the starting contactor and remains open. The equipment shuts down until the START Switch Button S-17A is again closed. Resistors R-35, R-34 prevents the line from becoming short-circuited when the STOP button S-17B is closed. Link Switches S-18, S-19 are provided to permit rapid selection of circuits for either 4- or 6-wire control. Rapid installation of the proper START-STOP Switch S-8 or S-17 is made possible by use of a small terminal block directly below the switch-mounting to which the switch is connected. Properly marked leads are attached to each switch to facilitate easy and correct wiring.

2-38 On all transmitter units, REMOTE-LOCAL Switch S-7 is used to switch the control of the transmitter units to the 4- or 6-wire Remote Control Units and/or the Radiophone Units.

2-39 TUNE-OPERATE Switch S-9 is intended for use as its name implies. It has three positions; the first, labelled TUNING STEP 1, is for use in making the adjustments of the master oscillator. When the switch is in this position, the plate voltage is removed from all of the amplifier stages. In the second or TUNING STEP 2 position, the plate potential is applied to all amplifier stages but at a safe value for tuning. In the third, or OPERATE position, the plate potential is increased to the operating value determined by the position of generator field Rheostat R-33 on the transmitter.

2-40 EMERGENCY SWITCH S-12 is used to shut down the complete equipment in case of an emergency. S-12 opens both sides of the control circuit power supply line, thus de-energizing all relays and shutting down the equipment.

2-41 Indicator lights are provided as follows: Reading from left to right: STARTING SOLENOID I-2 (Red), PLATE VOLTAGE I-3 (Red), HEATER CIRCUIT I-5 (Amber), BIAS VOLTAGE I-1 (Green) and M.O. FILAMENT I-4 (Clear).

2-42 In order to permit rapid adjustment of the master oscillator to any desired frequency within its range, provisions have been incorporated in the Transmitter Units for connection of a standard frequency measuring equipment, such as Model LD. To the left of the EMERGENCY Switch is located the FREQUENCY METER AUDIO OUTPUT Jack J-1, making the output from the frequency meter available at the transmitter, adjacent to the frequency determining controls.

MODULATOR

A. General

2-43 The Modulator Unit contains in a single frame, the necessary electrical circuits, tubes and control apparatus for taking power from a motor-generator set and delivering audio power for modulation of the Radio Transmitter Unit. Meters, controls, indicating lights, switches, etc., are mounted on and are accessible from the front panel. Two hand rails, similar to those on the transmitter unit, are furnished on the modulator. A door in the front panel permits access to the vacuum tube shelf. A similar door is provided at the bottom of the set for access to terminals. Interlocks are provided on the access doors to prevent personnel from coming in contact with high voltages. All sides, top and back shields are removable by means of thumb screws.

B. Mechanical

2-44 The mechanical features of the modulator may be seen by referring to the outline drawing and photographs. In addition to the meters and controls, there is a telephone handset and hook switch mounted directly on the front panel, so as to make LOCAL operation readily available. The controls located on the front panel may be identified by reference to Fig. 16. At the top of the frame is a meter panel on which are assembled six instruments in two rows of three instruments each. In the top row from left to right are MODULATOR PLATE CURRENT, Meter M-403, MODULATOR PLATE CURRENT, Meter M-404 and PERCENTAGE MODULATION, Meter M-405. In the second row in the same order are the INPUT AMP. PLATE CURRENT, Meter M-401, INT. AMP. PLATE CURRENT, Meter M-402 and FILAMENT VOLTAGE, Meter M-406. Below the second row of instruments are two nameplates. The one on the left mounts the indicator lights and toggle type switches. The lights are at the top of the nameplate and are from left to right. STARTING SOLENOID Indicator Light I-403, BIAS VOLTAGE Indicator Light I-402 and PLATE VOLTAGE Indicator Light I-401. Below the indicator lights, and in the same order, are the MANUAL AUTOMATIC GAIN Switch S-402, TALK Switch S-404, and CARRIER CONTROL Switch S-403. In the upper row of the nameplate on the right-hand side of the panel are the SPEECH GAIN Attenuator R-401 and RECEIVER-VOLUME Attenuator R-429. Below, and on the center line of the nameplate is the VOICE RELAY SENSITIVITY Attenuator R-413. The combination Handset HS-401 is located adjacent to the tube access door. Beneath the handset is the CW-MCW-VOICE Switch S-405 to the right of which is the FILAMENT VOLTAGE Rheostat R-415. Tubes and certain apparatus associated with it are mounted on the tube shelf which is located just to the rear of the tube access door. Most of the remaining audio components are mounted on one of two floors, the lower one of which contains the modulator output coupling circuit. At the bottom of the set is located the terminal board with a terminal board access door in front of it. Also, located behind this door, are the filament circuit fuses and lines for remote speech input operation.

C. Electrical

2-45 The electrical operation of the modulator may best be understood by referring to schematic diagram Fig. 31, Dwg. T-7606019 and wiring diagram Fig. 34, Dwg. W-7300535. Starting at the upper left hand corner of the schematic diagram, the audio input of the modulator is obtained from any one of three sources of speech input. These three sources are as follows:

1. The local Handset HS-401
2. The Master Monitor Unit Navy Type CW-23071 or CW-23072
3. Radiophone Unit Navy Type CRV-23172 or CRV-23211

2-46 In the case of the last two types of speech input units, the audio output of the remote unit is fed into the 600 ohm line marked 1 and 2 on the schematic diagram. When the Type CW-23071 or CW-23072 Master Monitor units are used, Link Switch S-410 is removed in order to derive the remote microphone supply from the Master Monitor unit. This power is supplied at 12 Volts D.C. A similar power supply is available in the modulator for use with the local microphone. Other terminals are provided so that remote control may be had from the master monitor unit. For interconnection diagrams of Navy Type CW-23071 and 23072 units, see Figs. 43 and 44, Dwgs. M-7414346 and M-7414347 respectively.

2-47 Likewise, terminals are provided so that in case the Radiophone Units are used, remote control may also be had from them. In this case, the 12 Volt supply in the modulator is used for both local and remote microphones.

2-48 When audio input is obtained from a 600 ohm line, it is applied (with the local handset on the hook) through Switch S-401 and SPEECH GAIN Attenuator R-401 to the input terminals of Transformer T-402. This transformer in turn excites the grids of the two amplifier Tubes VT-401 and 402. The amplification continues through successive stages, consisting of Transformers T-403, T-404, and T-405 and vacuum Tubes VT-403, VT-404, VT-405 and VT-406. Full output of the modulator is applied through Transformer T-405, Capacitor C-408 and Choke L-404, to Terminal 32.

2-49 Meters M-401, M-402, M-403 and M-404 are plate meters for the various stages, as can be seen from the diagram. M-406 indicates filament voltage and M-405 percentage modulation. The amplifier will function either as a straight through amplifier or as a compressor-limiter amplifier. In the former case, the output voltage across Choke L-404 is proportional to input voltage across Transformer T-402; in the latter case it is not. The choice of these modes of operations is made by means of Switch S-402. Compressor-limiter action is afforded by means of vacuum Tube VT-409 in conjunction with a winding on Transformer T-404. Operation of this feature is such as to compress the higher values of input voltage. The smaller the input voltage the greater is the overall gain of the amplifier. Vacuum Tube VT-409 also acts as limiter. Voltage applied to the input circuit in excess of that required for 100% modulation is prevented from damaging the equipment.

2-50 The three modes of operation, CW, MCW, and VOICE, are selected by Switch S-405. In CW position, this switch short-circuits Choke L-404, Meter M-405, Choke L-405 and Resistor R-416. In MCW position this switch closes the plate circuit to Tubes VT-405 and VT-406 to make them operative. The switch also provides filament power in the MCW position, closes the tone oscillator circuit and removes the short-circuit across Choke L-404. It also inserts Resistor R-416 into the plate circuit of the transmitter power amplifier to reduce the voltage to a suitable value for modulation. In VOICE position, the functions of Switch S-405 are the same as in MCW position, except that the plate circuit of tube VT-401 and VT-402 is closed, the tone oscillator circuit opened and the short circuit across Meter M-405 is removed. Other contacts on this switch operate in conjunction with the radiophone units as described in Section IV "Operation."

2-51 It is possible by means of the vacuum tube relay, consisting of Tube VT-408 in conjunction with Relay K-401, to operate the transmitter simply by talking into a remote microphone. This feature is optional and may be selected by Switch S-403. In the MANUAL position of this switch, it is possible to control the transmitter carrier by means of the "Press-to-Talk" button on the local microphone.

2-52 Switch S-404 is a TALK-LISTEN switch and has an OFF or center position. This switch has two operating positions, the upper one which is a locking position and the lower one, a non-locking position. In the lower position, the switch is used as a key, whereby the transmitter can be keyed locally

from the front of the modulator. In the upper position, the switch performs the same function as a locked key.

2-53 All plate voltages are obtained from the proper type motor-generator set. Plate voltage for all tubes except the VT-405 and VT-406 are obtained from the bias or exciter generator, which has a normal output voltage of 275 volts. Suitable operation voltages for plate grid and screen of Tubes VT-401, VT-402, VT-403, VT-404, VT-408 and VT-409 are obtained from a bleeder composed of Resistors R-414, R-419, R-420, and R-421. Note that the exciter voltage (275 volts) is grounded on the positive side.

2-54 Tubes VT-405 and VT-406 receive their plate voltage from the 2000 volt armature of the high voltage generator. Filament power for all tubes, and power for the Rectox RX-401 which supplies 12 Volts D.C. for microphone purposes, is obtained from Transformer T-408.

2-55 Modulation is applied to the radio transmitter power amplifier 3000 volt plate lead which enters the modulator on Terminal 22. In either MCW or Voice operation, Resistor R-416 is inserted to reduce the plate voltage on the power amplifier tube to 2700 volts. Also, Choke L-404, Meter M-405 and Transformer T-406 are inserted in the lead before it leaves the modulator on Terminal 32. Additionally, screen modulation is applied to the power amplifier tube through Capacitor C-420 and Choke L-405.

2-56 Screen and suppressor power for the Type 803 Tubes VT-405 and VT-406 is obtained for a potentiometer located in the transmitter. Protective spark gaps are provided across Transformer T-405, and Reactor L-404. In addition, a limiter Tube VT-407 is provided to prevent surges from damaging the output circuit. This tube functions in such a manner that it will limit surges to a value very slightly exceeding 100% modulation.

2-57 MCW operation is provided by an 800 cycle oscillator comprising Tubes VT-403, and VT-404, Reactor L-403 and Capacitor C-405. In the MCW position of Switch S-405, the oscillator circuit is closed through contacts of S-405 and the keying relay. In MCW operation, both the modulator and the carrier are thus keyed.

POWER EQUIPMENT

A. Motor-Generator

2-58 For the convenience of the reader, a tabulation of the various Motor-Generator Types and their component units is given below:

Motor Gen. Type	Driving Motor Type	Rating
CAY-21675	CAY-21678	115 V. D.C.
CAY-21676	CAY-21681	230 V. D.C.
CAY-21677	CAY-21682	220/440/3/60
H.V. Gen. Type	**L.V. Gen. Type**	**Rating**
CAY-21680	CAY-21679	115 V. D.C.
CAY-21680	CAY-21679	230 V. D.C.
CAY-21680	CAY-21679	220/440/3/60

Note: All driving motors are rated at 5 horsepower. The 60 cycle A.C. motors are rated at 1750 rpm., and the D.C. motors are rated at 1800 rpm.

2-59 The motor-generator sets supplied as part of Navy Model TBM-11 Radio and Telegraph and Transmitting Equipment, are of rugged design. These M.G. sets have ample capacity for the satisfactory operation of the transmitter alone or in combination with a Navy Type CAY-50065-A Modulator. The machines have the following rating:

Main Plate Generator Type CAY-21680, 3000 Volts—0.35 Amp. D.C. and 2000 Volts—0.75 Amp. D.C.

M.O. Plate and Bias Generator Type CAY-21679, 1000 Volts—0.075 Amp. D.C. and 275 Volts—1.3 Amp. D.C.

Driving Motor—5 H.P.

D.C. motors supply 535 watts A.C. power from slip rings.

2-60 Motors suitable for operation from the various power supplies are described below.

2-61 The motors and generators are semi-enclosed, constant speed, continuous duty, self-ventilating and drip proof from all angles within the limits of 45° on either side of the vertical and included in any plane perpendicular to the axis. The units are rated on the basis of 40°C. temperature rise in an ambient temperature of 50°C.

2-62 The various units of the motor-generator unit are fitted with ball bearings and are flexibly coupled together and mounted on a cast steel bedplate. They are so designed and constructed that the entire motor-generator unit may be moved about or supported at its extreme ends while running without disturbing the alignment of the units. Any unit may be removed without necessitating the removal of any other unit on the bedplate.

2-63 The D.C. generators are excited from the bias generator. Fuses are installed on the terminal boards of all generators to protect them against damage due to the failure of any part of the equipment.

(1) Main Plate Generator Type CAY-21680

2-64 The double commutator 2000 and 3000 volt D.C. plate power generator Type CAY-21680 is compound wound and separately excited from the 275 volt D.C. bias generator Type CAY-21679. It is rated at 2.31 Kw. for 40°C. temperature rise and will deliver .75 amperes at 2000 volts and .35 amperes at 3000 volts. This unit consists of a single core generator with a commutator mounted on each end. There are two main poles and two commutating poles. There are two output windings in the armature slots. A 2000 volt winding connects to the commutator on the motor end of the machine, and a 1000 volt winding connects to the commutator on the blower end of the unit. The output from these two circuits is connected in series so that there is available from the unit both 2000 and 3000 volt outputs. All terminals and fuses are mounted on ceramic insulators. This unit is used to supply the plate and screen grid power to the intermediate amplifiers, power amplifier, and to the Modulator Unit when it is used. See drawings CAY-T-155 Sheets 11 and 12, Drawings 33-J-173, and 33-J-174.

(2) Master Oscillator Plate and Bias Generator Type CAY-21679

2-65 The 275 and 1000 volt D.C. generator Type CAY-21679 is compound wound. Its shunt field is excited from the 275 volt winding, and the compound winding is connected in series with the 1000 volt winding. The 1000 volt winding is connected to the commutator at the shaft projection end of the machine. The generator is rated at .43 Kw. continuous load for 40°C. temperature rise and will deliver 1.3 ampere at 275 volts D.C. and .075 ampere at 1000 volts D.C. The unit has a two-pole field and double commutator two winding armature as shown on CAY-T-155, sheets 13, and 14, Dwgs. 33-J-175, and 33-J-176. The generator is used to supply 275 volts for amplifier tube bias and generator excitation; and plate, screen and bias voltages for the first two audio stages in the Modulator Unit, when used. The 1000 volt winding is used to supply plate and screen grid power for the master oscillator tube. The terminals and fuse of the 1000 volt circuit are mounted on ceramic insulators. A porcelain fuse block is used for the 275 volt circuit.

(3) Induction Motor Type CAY-21682

2-66 The 220/440 volt, 3 phase, 60 cycle, motor Type CAY-21682 is of the induction type and rated 5 horsepower, 1750 rpm. The stator winding consists of twelve groups of three coils each. There are, therefore, four groups per phase. The motor may be connected for either 220 volts or 440 volts, 3 phase. For 440 volt operation, the four groups per phase are connected with a single star. For 220 volt operation, two groups per phase are connected in series and the six series groups are connected into two stars in parallel. The motor is designed for full voltage starting. See CAY-T-155, sheet 15, Dwg. 33-J-185.

2-67 Full directions for proper group connections to permit 220 or 440 volt operation of the A.C. motor Type CAY-21682 are given on the interconnection diagrams, and on the equipment schematic diagrams for the various models.

(4) D.C. Motor Type CAY-21678

2-68 The 115 volt D.C. motor Type CAY-21678 is of the shunt wound type and is rated at 5 H.P., 1800 rpm. The motor is provided with four main poles and two commutating poles. A pair of slip rings are mounted on the armature shaft opposite the commutator. The armature winding is tapped at two points and connected to the slip rings. A.C. power output of 535 watts, 80 volts, 60 cycle, single phase is available from the slip rings for filament heating.

(5) D.C. Motor Type CAY-21681

2-69 The 230 volt D.C. motor Type CAY-21681 is of the shunt wound type and is rated at 5 H.P., 1800 rpm. The motor is provided with four main poles and two commutating poles. A pair of slip rings are mounted on the armature shaft opposite the commutator. The armature winding is tapped at two points and connected to the slip rings. A.C. power output of 535 watts, 160 volts, 60 cycle, single phase is available from the slip rings for filament heating.

B. Magnetic Controllers

2-70 The magnetic controllers supplied as part of of the Navy Model TBM-11 Transmitting Equipment are of the remote controlled, drip-proof, protected magnetic contactor type. All of the contactors, relays and resistors, associated with the controller are assembled on an insulated panel and mounted in a sheet steel box.

(1) **Magnetic Controller Type CAY-211231**

2-71 The magnetic controller Navy Type CAY-211231, 115 Volt D.C. is rated 5 H.P. and is of the Class A shockproof type. The complete controller consists of a line contactor, a thermal overload relay, two time delay accelerating contactors, one control circuit fuse, one control circuit resistor and one starting resistor all mounted on an insulating panel. This panel is mounted in a hinged, sheet steel box. See Fig. 37 and CAY-T-155, Dwgs. P-7713319 and 45-J-406, for overall and outline dimensions and schematic and wiring diagrams.

(2) **Magnetic Controller Type CAY-211232**

2-72 The magnetic controller Navy Type CAY-211232, 230 volt, D.C. is rated at 5 H.P. and is of the Class A shockproof type. The complete controller consists of a line switch, a line contactor, a thermal overload relay, two time delay accelerating contactors, one control circuit fuse, one control circuit resistor and one starting resistor all mounted on an insulating panel. This panel is mounted in hinged, sheet steel box. See Fig. 37 and CAY-T-155, Drawings P-7713319 and 45-J-408, for overall and outline dimensions and schematic and wiring diagrams.

(3) **Magnetic Controller Type CAY-211233**

2-73 The magnetic controller Navy Type CAY-211233, 440 volts, 3 phase, 60 cycle is rated 5 H.P. and is of the across-the-line type. This complete controller consists of two line fuses, a line contactor and a thermal overload relay all mounted on an insulating panel. The panel is assembled in a hinged, sheet steel cabinet. See Fig. 38 and CAY-T-155, Dwgs. P-7713237 and 45-J-405 for overall and outline dimensions and schematic and wiring diagrams.

III. Installation and Adjustment

A. General

3-1 The installation force should become generally familiar with the Description, Installation, and Operation Sections of this book prior to proceeding with the installation. When installing the Transmitter Unit, reference should be made to the interconnection drawings showing the interconnection wiring and recommended wire sizes and types and interconnecting directions.

3-2 In the unpacking and handling of the units during process of installation, care should be exercised to prevent damage to equipment. The following precautions should be observed.

1. Keep boxes and crates containing equipment in an upright position at all times. The upright position is indicated by an arrow pointing upward, stenciled on each box or crate.
2. Observe weights marked on boxes, crates and units, as the larger unit weighs from 1000 to 1500 pounds when packed. Adequate transporting and lifting gear and sufficient handling personnel should be available to prevent equipment from being subjected to unwarranted shock.
3. Remove at least three sides from boxes or crates by removing nails with a nail-puller; do not use a hammer or pinch bar for this purpose.

3-3 The various units should be carefully uncrated and all wrappings removed. The shields should be removed and each compartment given a thorough inspection to determine any damage caused by shipment.

3-4 The Test Data and Instruction Book secured inside the front cover of the Radio Transmitter Unit packing box, after acceptance by the Inspector, should be removed and the Test Data placed in the copy of the Instruction Book for use during the installation.

3-5 Any components or wiring which may have been displaced during shipment should be replaced in their proper locations. The shock absorbers on the tube shelves should be inspected to see that they permit normal motion and are not cracked or unduly distorted.

3-6 The interconnection wiring diagrams for any equipment are tabulated below:

Equipment	Figure	Mfg. Dwg. No.
TBM-11-A.C.	41	T-7613303
TBM-11-D.C.	42	T-7613302
TBM-11	43	M-7414346
TBM-11	44	M-7414347

3-7 The diagram covering the proper equipment should be studied and followed carefully. These diagrams show the type, size and insulation of wire and cable recommended for interconnecting the different units of any one equipment. Complete instructions for the proper connections of motors, transformers, and link switches are contained on the interconnection diagrams for the various equipments.

3-8 After completing the installation of any one equipment, according to the installation description for the various units, and before connecting to the supply line, carefully check all interconnection wiring performed by the installation force. This check should be performed by approved circuit check test practices to insure that all circuits are complete, according to the proper interconnection wiring diagram.

3-9 After thoroughly checking all interconnection wiring, as to proper connection, wire size, and insulation, the preliminary tests of the various units may be carried out.

B. Transmitter Installation

3-10 The Radio Transmitter unit should be installed so that all sides are accessible. Provide for sufficient clearance, preferably not less than 18 inches on the left or master oscillator side so that the master oscillator unit can be removed after installation without making it necessary to unbolt the Radio Transmitter Unit from its foundation. Before the Radio Transmitter is secured in place, all of the wood blocking should be removed from around the master oscillator unit. The hold-down bolt should be completely removed from the bottom of the unit so that the unit hangs free on its supporting springs. After this is done, the shields should be replaced and the transmitter securely fastened to the foundation by means of one-half inch studs or bolts, through the holes provided in the mounting channels. For Transmitter Units, Type CAY-52171, Type CAY-52217 and Type CAY-52218, see Outline Dwg. Fig.

35, Dwg. T-7611719. This drawing shows the location of mounting holes. The antenna lead should be made up of ⅜ or ½ inch O.D. copper tubing and should be kept at least six inches away from any grounded objects.

3-11 The frames of the Radio Transmitter Unit, Motor-Generator Unit, Magnetic Controller and Modulator Unit should be electrically tied together and grounded by a copper strap at least 1 inch wide and 1/32 inch thick, making certain that a metal-to-metal contact is made at each point of contact.

C. Rating and Range

3-12 The Radio Transmitter is suitable for use with any antenna whose characteristics fall within the limits listed in Par. 2-2, which describes antenna and antenna trunk dimensions.

3-13 Under these conditions, the Radio Transmitter Unit will deliver the power given in the following table, using a Type 861 tube in the final amplifier.

Frequency (Kcs.)	Output Watts
2000 to 3035 Inclusive	500
3035 to 4105 "	475
4105 to 6000 "	450
6000 to 7500 "	400
7500 to 9050 "	375
9050 to 12000 "	360
12000 to 16000 "	325
16000 to 18100 "	300

A 500 watt, 110 Volt Mazda "C" Lamp, practically non-reactive resistance between antenna terminal and ground, may be used to check power output at all frequencies.

D. Power Supply Line Requirements

3-14

	115 D.C.	230 D.C.	440 A.C.
Max. Power for Starting (KW)	10	10	21
Voltage Variation Permitted	±10%	±10%	∓10%
Power for Locked Key (KW)	4.3	4.3	4.3
Supply Frequency Variation Permitted	....	....	± 5%

(Power required for starting measured by critically damped instrument)

E. Modulator Installation

3-15 The modulator should be installed so that all sides are accessible for inspection of the equipment and possible replacement in case of trouble. The modulator should be securely fastened to the foundation by means of ½ inch studs or bolts through holes provided in the mounting channels. See outline drawing Fig. 36, Dwg. P-7711695 for location of mounting holes. The location of these mounting holes should be such that when the modulator is finally fastened down, it will not be more than three feet from the transmitter unit with which it is to operate, and preferably a shorter distance.

3-16 For Modulator Unit Type CAY-50065-A refer to Fig. 34, Dwg. W-7300535. Remove link Switch S-410 if CW-23071 or CW-23072 Master Monitor Units are used. Change position of link Switches S-408 and S-409 if the receiver attenuator relay uses 115 Volt D.C. coil supply. Connections between units should be made according to Figs. 41, 42, 43 or 44, Dwgs. T-7613303, T-7613302, M-7414346 or M-7414347. These diagrams show the interconnections between the Radio Transmitter Unit, the motor-generator, the remote speech equipment, and the Modulator Unit. Note that the lead connecting Terminal 32 on the modulator with the terminal of the same number on the transmitter should be kept as short as possible, and less than five feet in length at most.

3-17 If more than one Radiophone Unit is used with the equipment certain connections are made through a distribution panel and some through the modulator. Figs. 41 or 42, Dwgs. T-7613303 or T-7613302 illustrates the manner of making these connections to one Radiophone Unit. For more than one unit, refer to the instruction book on the Radiophone Unit. Figs. 43 or 44, Dwg. M-7414346 or M-7414347 illustrate the manner of making connections to Master Monitor Unit Types CW-23071 or CW-23072.

3-18 The modulator should be tied electrically to the same ground system as the radio transmitter and motor-generator frame by a copper strap at least one inch wide and 1/32 inch thick, making certain that a metal-to-metal contact is made at each joint.

3-19 The maximum power supply line requirements for either A.C. or D.C. operation will be 5.7 KW for full power, locked key, one hundred per cent modulation. The voltage variations permitted will be plus or minus ten per cent, and the supply line frequency variation permitted plus or minus five per cent.

F. Motor-Generator and Magnetic Controller Installation

3-20 The motor-generator units used with TBM-11 equipment should be securely bolted to the floor in a place as free as practical from dust and moisture. Overall and mounting dimensions of the motor-generator units are shown on Figs. 39 and 40, Dwgs. T-7611739 and T-7611738, respectively.

3-21 The magnetic controller units should be securely bolted in place near the motor-generator units. Figures 37 and 38, Dwgs. P-7713319 and P-7713237 show the overall and mounting dimensions of the magnetic controller units used with the various equipments. The overload relay should be adjusted to operate at a current value indicated in the following table.

Normal Magnetic Controller Overload Relay Setting

Controller Rating	Overload Relay Setting Amperes
230 Volt D.C.	32 Amp.
115 Volt D.C.	64 Amp.
220/3/60 A.C.	17 Amp.
440/3/60 A.C.	8.4 Amp.

G. Warning

3-22 *Warning! Operation of this equipment involves the use of high voltages which are dangerous to life. Operating personnel must at all times observe all safety regulations. (See Page v.) Do not change tubes or make adjustments inside equipment with high voltage supply on. Do not depend upon door switches or interlocks for protection but always shut down the motor-generator, or other power equipment, and open the main line switch in supply line to equipment. Interlocks are provided on normal access doors only. Always ground internal units or circuits before touching them. Under certain conditions, dangerous potentials may exist on circuits after shut-down due to charges retained by capacitors. Always discharge the filter capacitors as some may be holding dangerous charges, even though the power may not be on the set. There are bleeder resistors or other circuits across the power filter capacitor, but the additional precaution of grounding the filter capacitors is essential in case the capacitors have not completely discharged. When shutting down the equipment, never reach inside any unit until the motor-generator set has stopped revolving, as dangerous potentials are generated at all speeds. All necessary precautions should be observed to prevent injury to personnel.*

H. Preliminary Checks Transmitter

3-23 All link switches must be in their proper position before power is applied to the equipment. Make sure that the proper resistors are in place in accordance with the schematic diagrams. For four or six wire control, make connections as shown on Interconnection diagrams.

3-24 Refer to Fig. 1, showing the location of the controls, and with no tubes in the Radio Transmitter Unit, place all transmitter controls as follows:

3-25 Turn the filament Rheostat R-6 and field Rheostat R-33 counterclockwise to maximum resistance position.

3-26 HIGH-LOW POWER Switch S-3 to the HIGH position.

3-27 LOCAL-REMOTE Switch S-7 to LOCAL.

3-28 TUNE-OPERATE Switch S-9 to TUNING STEP 1. TEST Key S-10 to NEUTRAL.

3-29 START-STOP Switch S-8, S-17 to STOP.

3-30 EMERGENCY SWITCH S-12 to ON.

3-31 EMISSION Switch S-405 on the Modulator Unit to CW. See Paragraph 2-50.

3-32 Close all access doors to transmitter, controller and modulator.

3-33 M. O. FILAMENT STAND-BY Switch S-27 to ON. (A.C. equipment only.)

3-34 Push in OVERLOAD RELAY RESET Button.

3-35 Power is supplied to the Radio Transmitter Unit, used as a part of the Model TBM-11 equipments whenever power is applied to the line terminals of the magnetic controller. This power is used for operation of the master oscillator heater system, the transmitter unit control circuits, and in the case of A.C. equipments, the master oscillator filament Transformer T-12. This power is always available at the Radio Transmitter Unit regardless of whether or not the motor-generator is in operation.

3-36 As soon as power is applied to the Transmitter Unit, the following operation should take place in the Radio Transmitter Unit:

(a) The Blower Motor B-11, B-1 should run.

(b) The HEATER CIRCUIT Indicator Lamp I-5 (Amber) should light.

(c) The M.O. FILAMENT Indicator Lamp I-4 (Clear) should light. (A.C. equipments only.)

3-37 A.C. Equipment Only

Place the M.O. Filament STAND-BY POWER Switch S-27 to the OFF position. The M.O. FILAMENT Indicator Lamp I-4 (Clear) should go out.

3-38 Apply filament and plate power (1500 volts) by placing the START-STOP Switch S-8, S-17 on the Radio Transmitter Unit to START.

(a) Starting Contactor K-14, K-4 should close.
(b) STARTING SOLENOID Indicator Lamp I-2, I-6 (Red) should light.
(c) Motor-generator should start and come up to normal speed in approximately 5 to 10 seconds.
(d) FILAMENT VOLTAGE Voltmeter M-11 in the Radio Transmitter Unit should indicate approximately 12 volts.
(e) M.O. FILAMENT Indicator Lamp I-4 (Clear) should light.
(f) Field Contactor K-19, K-9 should close.
(g) BIAS VOLTAGE Indicator Lamp I-1 (Green) should light and BIAS VOLTAGE Voltmeter M-12 should indicate approximately 275 volts.
(h) PLATE VOLTAGE Voltmeter M-9 will not indicate but plate voltage (1000 volts) will be applied to the master oscillator plate and screen grid terminals.
(i) PLATE VOLTAGE Indicator Lamp I-3 (Red) should light.

3-39 Test out the door interlocks by opening one door at a time. The motor-generator and Radio Transmitter Units should shut down (except master oscillator heater and blower motor in the transmitter when any access door is open, and start again when the access door is closed.

3-40 Place EMERGENCY SWITCH S-12 to STOP. The motor-generator unit should shut down but power remains on the blower motor and master oscillator heater. On 4-wire control systems, the motor-generator unit should start when EMERGENCY SWITCH S-12 on the Radio Transmitter Unit is placed in the ON position. On 6-wire control systems, it will be necessary, after closing the EMERGENCY SWITCH, to close START-STOP Switch S-17A before the motor-generator will start.

3-41 Apply reduced plate voltage (1000 volts) on the intermediate and power amplifiers by placing TUNE-OPERATE Switch S-9 to TUNING STEP 2. PLATE VOLTAGE Voltmeter M-9 should indicate voltage of the 2000 volt armature, which should be about 1000 volts because Field Rheostat R-33 is in the minimum voltage position.

3-42 Apply increased plate voltage (1500 volts) on intermediate and power amplifiers by placing TUNE-OPERATE Switch S-9 to OPERATE. PLATE VOLTAGE Voltmeter M-9 should indicate the voltage of the 3000 volt terminal, which is about 1500 volts, as the Field Rheostat is still in minimum voltage position.

3-43 Operate TEST Key S-10 on Radio Transmitter Unit.
(a) Keying Relay K-1 should operate.
(b) Compensator Relay K-2 should close.

3-44 Shut down the motor-generator and transmitter by placing the START-STOP Switch S-8, S-17 to STOP.

3-45 Return TUNE-OPERATE Switch S-9 to TUNING STEP 1.

3-46 Leave LOCAL-REMOTE Switch S-7 in the LOCAL position.

3-47 Place a Type 860 tube in the tube sockets of the master oscillator unit, first and second intermediate amplifiers, and a Type 861 tube in the tube mounting of power amplifier. Make all tube connections, being certain to connect the auxiliary screen grid terminal for the power amplifier tube. This connection is located to the rear of the Type 861 power amplifier tube.

3-48 Apply filament and plate voltage (1500 volts) to the equipment by placing START-STOP Switch S-8, S-17 to START. Adjust the FILAMENT VOLTAGE of the transmitter vacuum tubes to 10 volts as indicated by FILAMENT VOLTAGE Voltmeter M-11 and controlled by FILAMENT VOLTAGE Rheostat R-6. The FILAMENT VOLTAGE Voltmeter M-11 is connected across the filaments of the first and second intermediate amplifier Type 860 tubes instead of across the filaments of the Type 861 tube. The reason being that in the LOW POWER position, the Type 861 tube is not used as the Power Amplifier and is, therefore, disconnected. When the filament voltage Voltmeter M-11 indicates 10 volts, the correct potential is applied to all tubes; 10 volts to the Type 860 and 11 volts to Type 861. Shut down the motor-generator unit and Radio Transmitter Unit by placing START-STOP Switch S-8, S-17 to STOP.

3-49 In conducting the following preliminary installation tests, have at hand one copy each of Routine Test Data, or Type Test Data, that bears the same serial number as the Radio Transmitter Unit and is packed inside the Transmitter Unit after

inspection by the Navy Inspector. This Test Data contains the exact dial and control settings for various frequencies between 2000 and 18100 Kcs. taken on this particular Transmitter Unit during Navy Acceptance Test at the manufacturer's plant. Although in service the frequencies desired will not be the same as those shown on Test Data. The approximate dial and control settings can be obtained by interpolation. By carefully following this Test Data, it will be possible to select the correct harmonic of each tuned circuit and avoid the possibility of tuning to a harmonic of a previous stage when the fundamental was desired or vice versa. Approximate calibration curves are given in Figures 45, 46, 47 and 48, Curves Nos. 226373, 218634, 218636 and 218635. A table of Typical Dial and Tap Settings and a table of Typical Meter Readings are given on Figures 56 and 57. For a preliminary test, the following settings will be approximately correct for a frequency of 2000 Kcs. The various tuning controls are identified by letters as marked on the panel, followed by symbol designations used on the schematic diagrams.

3-50 Close all access doors of the equipment.

3-51 Set Radio Transmitter Unit controls as follows:

(a) Set START-STOP Switch S-8, S-17 to STOP.
(b) Set LOCAL-REMOTE Switch S-7 to LOCAL.
(c) Set TUNE-OPERATE Switch S-9 to TUNING STEP 1.
(d) Set EMERGENCY SWITCH S-12 to ON.
(e) Set the MASTER OSCILLATOR RANGE Switch (Control A) S-1 on Tap 1.
(f) Set MASTER OSCILLATOR TUNING (Control B) L-1 to 1872 divisions.
(g) Set DOUBLER CIRCUIT TUNING (Control C) C-14 to 18 divisions.
(h) Set FIRST INTERMEDIATE AMPLIFIER TUNING (Control D) C-21 to 26 divisions.
(i) Set SECOND INTERMEDIATE AMPLIFIER TUNING (Control E) L-9 to .053 divisions.
(j) Set POWER AMPLIFIER TUNING (Control F) L-14 to .059 divisions.
(k) Set FREQUENCY RANGE SWITCH (Control L) S-2 for the 2000 to 4000 kilocycle range.
(l) Set ANTENNA COUPLING (Control H) C-41 to 1500 divisions.

3-52 Start up the motor-generator unit and transmitter, applying plate voltage of 1500 volts by placing the START-STOP Switch S-8, S-17 to START. Perform the following adjustments on the Radio Transmitter Unit.

3-53 Check FILAMENT VOLTAGE Voltmeter M-11 and adjust, if necessary, to 10 volts by means of FILAMENT VOLTAGE Rheostat R-6.

3-54 Operate TEST Key S-10. The M.O. PLATE CURRENT Meter M-7 and M.O. SCREEN GRID CURRENT METER M-8 should indicate current of about 60 and 11 ma., respectively.

3-55 Set TUNE-OPERATE Switch S-9 to TUNING STEP 2 and adjust Field Rheostat R-33 until PLATE VOLTAGE Voltmeter M-9 indicates 2000 volts.

3-56 Operate TEST Key S-10 and adjust DOUBLER CIRCUIT TUNING (Control C) C-14 for maximum indication on 1ST INT. AMP. PLATE CURRENT Meter M-6. (Approximately 60 ma.)

3-57 Adjust 1st INTERMEDIATE AMPLIFIER TUNING (Control D) C-21 for minimum indication on 1ST INT. AMP. PLATE CURRENT Meter M-6 or maximum indication on 2ND INT. AMP. GRID CURRENT Meter M-5. (Approximately 25 ma. on M-6 or 25 ma. on M-5.)

3-58 Adjust 2nd INTERMEDIATE AMPLIFIER TUNING (Control E) L-9 for minimum indication on 2ND INT. AMP. PLATE CURRENT Meter M-4 or for maximum indication on P.A. GRID CURRENT Meter M-3. (Approximately 50 ma. on M-4 or 60 ma. on M-3.)

3-59 Adjust POWER AMPLIFIER TUNING (Control F) L-14 for minimum indication on P.A. PLATE CURRENT Meter M-2.

3-60 If antenna is under 50 feet long, or over 80 feet long, set ANTENNA FEED Switch S-6 to CURRENT FEED. If between 50 and 80 feet in length, set the ANTENNA FEED Switch S-6 to VOLTAGE FEED. (The dimensions are only approximate.)

3-61 If ANTENNA FEED Switch S-6 is in CURRENT FEED position, set ANTENNA TUNING INDUCTANCE (Control K) L-13 to 0 and adjust ANTENNA TUNING CAPACITOR (Control J) C-42 for maximum output as indicated on ANTENNA CURRENT Meter M-1.

3-62 If ANTENNA FEED Switch S-6 is in VOLTAGE FEED position, set ANTENNA TUNING INDUCTANCE (Control K) L-13 to 1000 divisions and adjust ANTENNA TUNING CAPACITOR (Control J) C-42 for maximum indication on P.A. PLATE CURRENT Meter M-2.

3-63 If P.A. PLATE CURRENT Meter M-2 indicates over 150 milliamperes, reduce ANTENNA COUPLING (Control H) C-41.

3-64 Set TUNE-OPERATE Switch S-9 to OPERATE and adjust Field Rheostat R-33 until PLATE VOLTAGE Voltmeter M-9 indicates 3000 volts. Close TEST Key S-10 and readjust ANTENNA TUNING CAPACITOR (Control J) C-42 for maximum output on ANTENNA CURRENT Meter M-1. At the same time adjust ANTENNA COUPLING (Control H) C-41, if necessary, to keep P.A. PLATE CURRENT Meter M-2 to a value *not in excess* of 350 milliamperes. It may also be necessary to slightly readjust the POWER AMPLIFIER TUNING (Control F) L-14 for minimum value on P.A. PLATE CURRENT Meter M-2 due to antenna effects. Optimum efficiency of operation is the condition giving maximum indication on the ANTENNA CURRENT Meter M-1 with the minimum indication on P.A. PLATE CURRENT Meter M-2. Refer to Fig. 57, or Test Data which acompanies unit for typical meter readings which were taken with the TUNE-OPERATE Switch S-9 on OPERATE.

3-65 NOTE: In order to resonate the antenna, it may be necessary to try various combinations of ANTENNA TUNING INDUCTANCE (Control K) L-13 and Capacitor (Control J) C-42, also VOLTAGE or CURRENT FEED to the antenna to obtain maximum output without the power amplifier being overloaded.

3-66 When operating the transmitter on lower power, with the HIGH-LOW POWER Switch S-4, S-5 in LOW POWER position, the unit should be tuned as described. However, the following exceptions apply: The POWER AMPLIFIER TUNING (Control F) L-14 and the P.A. GRID CURRENT Meter M-3 is omitted. The ANTENNA COUPLING (Control H) C-41 is so adjusted that the second intermediate amplifier (now used as a final amplifier) 2ND INT. AMP. PLATE CURRENT Meter M-4 *does not exceed* 150 milliamperes. It is to be recalled that the upper limiting frequency is 9050 Kcs. in the LOW POWER position.

3-67 The PLATE VOLTAGE Voltmeter M-9 should not exceed 3000 volts regardless of the position of the HIGH-LOW POWER Switch. This can be adjusted by generator field Rheostat R-33. The 2000 volt circuit of the main generator is used to supply plate and screen grid voltage (2100 volts maximum) to the Type 860 tubes in the first and second intermediate Amplifier stages. This voltage is indicated on PLATE VOLTAGE Voltmeter M-9 when the TUNE-OPERATE Switch S-9 is on Step 2. The PLATE VOLTAGE Voltmeter M-9 always indicates the voltage which would be applied to the plate of the Type 861 tube if the HIGH-LOW POWER Switch S-5 was on HIGH POWER.

3-68 When adjusted to the frequency of 2000 Kcs. normal output, record setting of all frequency determining controls. Shut down the equipment by placing START-STOP Switch S-8, S-17 to STOP.

I. Preliminary Checks, Modulator

3-69 With no tubes in the modulator, place modulator controls in the following positions.

(a) Turn the FILAMENT VOLTAGE Rheostat R-415, to the maximum resistance position which is also maximum counterclockwise position.

(b) CW-MCW-VOICE Switch S-405 to CW position.

(c) SPEECH GAIN Attenuator R-401, VOICE RELAY SENSITIVITY Attenuator R-413 and RECEIVER VOLUME Attenuator R-429 to zero position.

(d) MANUAL-AUTOMATIC GAIN Switch S-402 to MANUAL position.

(e) TALK Switch S-404 to center (OFF) position.

(f) CARRIER CONTROL Switch S-403 to MANUAL position.

(g) HANDSET HS-401 on hook.

3-70 Adjust links on Transformer T-408 and T-409 for the proper power supply per wiring diagram Fig. 34, Dwg. W-7300535.

3-71 Insert Fuses F-401 and F-402 in the fuse block just inside the terminal board access door. Close all modulator unit access doors and screens.

3-72 In A.C. equipments, filament power is supplied to the modulator whenever power is applied to the magnetic controller Terminals A.C. 1 and A.C. 3. In D.C. equipments, this power comes in through the transmitter terminal board on Terminals 38 and 39, which bear the same number on the Modulator Unit. From the transmitter, the same terminals run to the slip rings on the motor-generator set driving motor. Therefore, filament power is available at the modulator on D.C. equipments, only when the motor-generator set is running. However, the filaments do not light when Switch S-405 is in the CW position. When the motor-generator is started, Indicator Light I-403 (red) will indicate, regardless of the position of Switch S-405. Also, after the motor-generator set

is running, Indicator Light I-402 (green) will indicate, showing that bias voltage and plate voltage for the lower power stages is also available. Switch S-405 should be turned to the three positions CW-MCW-VOICE in order to check the above operation.

3-73 When plate power is applied it is indicated by Indicator Light I-401 (red). Test out the door interlocks by opening one door at a time.

3-74 Insert a complete set of vacuum tubes in corresponding tube sockets as follows:

VT-401 insert Type 6D6
VT-402 insert Type 6D6
VT-403 insert Type 807
VT-404 insert Type 807
VT-405 insert Type 803
VT-406 insert Type 803
VT-407 insert Type 1616
VT-408 insert Type 807
VT-409 insert Type 25Z5

3-75 It will now be possible to adjust modulator filament voltage after starting the motor-generator. Overload Relay K-5 in the transmitter should be opened to prevent application of plate voltage until modulator filament voltage is adjusted to the proper value. Gradually turn FILAMENT VOLTAGE Rheostat R-415, clockwise until Meter M-406 indicates exactly 10 volts.

3-76 With the filaments properly lighted, reset overload Relay K-5 in the transmitter. This supplies plate voltage (approximately 2000 volts) to the modulator tube. Meter readings, taken with Switch S-405 turned to the VOICE position, should then be approximately as follows:

(a) INPUT AMPL. PLATE CURRENT METER M-401 should read 3 ma.

(b) INT. AMPL. PLATE CURRENT METER M-402 should read 120 ma.

(c) MODULATION PLATE CURRENT METER M-403 should read 50 ma.

(d) MODULATION PLATE CURRENT METER M-404 should read 50 ma.

(e) FILAMENT VOLTAGE METER M-406 should read 10 volts plus or minus 2%.

3-77 Turn MANUAL-AUTOMATIC GAIN Switch S-402 to AUTOMATIC. Reading of INPUT AMP. PLATE CURRENT METER M-401 should change to about 5 ma. Return MANUAL-AUTOMATIC GAIN Switch to MANUAL and shut down the motor-generator set.

J. Preliminary Checks, Power Equipment

3-78 After completing the installation of the motor-generator unit and magnetic controller, carefully check all interconnection wiring. This check should be performed by approved circuit test practices to see that all circuits are complete.

3-79 Test on the power equipment must be conducted in conjunction with the tests of the transmitter unit, since the starting and stopping of the motor-generator sets is performed by circuits in the transmitter unit. Refer to paragraphs 3-23 through 3-42.

IV. Operation

Warning

4-1 *Operation of this equipment involves the use of high voltages which are dangerous to life. Operating personnel must at all times observe all safety regulations. See page v. Do not change tubes or make adjustments inside equipment with high voltage supply on. Do not depend upon door switches or interlocks for protection but always shut down the motor-generators or other power equipment and open main switch in supply line to equipment. Interlocks are provided on normal access doors only. Always ground internal units or circuits before touching them. Under certain conditions dangerous potentials may exist on circuits after shut-down due to charges retained by capacitors. Always discharge the filter capacitors as they may be holding dangerous charges, even though the power may not be on the set. There are bleeder resistors or other circuits across the power filter capacitors, but the additional precaution of grounding the filter capacitors is essential in case the capacitors have not completely discharged. When shutting down the equipment, never reach inside any unit until the motor-generator set has stopped revolving, as dangerous potentials are generated at all speeds. All necessary precautions should be observed to prevent injury to personnel.*

A. Overload Protection

4-2 The following overload protection is provided in the Radio Transmitter Unit.

4-3 The coils of H.V. overload Relay K-5 and M.O. plate overload Relay K-7 are located in the transmitter main plate, and master oscillator plate circuit respectively. Relay K-5 and Relay K-7 operate on overload to shut down the motor-generator set and the Radio Transmitter Unit by dropping out main starting Contactor K-14, K-4 and field Contactor K-19, K-9. These relays are manually reset from the front of the Radio Transmitter Unit panel.

4-4 On A.C. Transmitter Unit CAY-52171, heater circuit Fuses F-1 and F-2 (6 amp. 250 volts), located on the transmitter terminal board, protect the control circuits and the master oscillator temperature control system including heater Resistor R-26 and Blower Motor B-11. Additional Fuses F-13 and F-14 (6 amp. 600 volts) protect step-down Transformers T-14, and T-15 and associated circuits.

4-5 On Transmitter Units, Type CAY-52217, and Type CAY-52218, hearter circuit Fuse F-1 (6 amp. 250 volts), located on the transmitter terminal board, protects the master oscillator temperature system including Heater Resistor R-26 and D.C. Blower Motor B-1. Control circuit Fuse F-2 (6 amp. 250 volts) located on the Radio Transmitter Unit terminal board protects the D.C. control circuits.

4-6 Overload protection is provided for modulator Tubes VT-405 and VT-406 by means of overload Relay K-5 located in the Transmitter. When a modulator is employed, this relay should be adjusted to allow for approximately 250 ma. additional plate current in the 3000 volt generator lead.

4-7 Fuses mounted on the generator terminal boards protect the generator high voltage windings against faults in the high voltage cable between the generators and the Radio Transmitter Unit. See Paragraphs 2-64 and 2-65.

4-8 Overload Relay K-862 in the A.C. Controller unit provides short circuit protection to the controllers and motors. See Paragraphs 2-69 through 2-72.

4-9 Control fuses in the D.C. controller units protect the controller control circuits. See Paragraph 2-70.

4-10 In the controller, a thermal overload protective device protects the motor against overload. This relay is of the hand reset type. See Paragraphs 2-70 through 2-72.

4-11 Refer to Fig. 50 for pertinent information on adjustment of protective relays.

B. Transmitter Unit Operations

4-12 The Radio Transmitter Unit may be started and stopped by means of START-STOP Switch S-8, S-17. When LOCAL-REMOTE Switch S-7 is placed in REMOTE position, the transmitter may be started by pressing the remote starting switch on the 4- or 6-wire remote control unit. LOCAL control is always supervisory, in that START-STOP Switch S-8, S-17 on the Transmitter Unit will stop the equipment even when the remote starting switch has been closed.

4-13 In order to obtain the best performance regarding frequency stability and accuracy of calibration, the master oscillator heat compartment, in which are located the frequency determining elements, should be up to approximately 60°C (140°F.) temperature for normal operation. This will require approximately three hours after power has been applied. For this reason, the master oscillator heater circuit should be left ON at all times when operation of the transmitter is planned within three hours.

4-14 An indicating Thermometer Th-1 (Type CHB-40025) is provided having its bulb in the constant temperature compartment and its scale on the front panel of the transmitter. Under normal ambient temperature conditions of approximately 25°C., Thermometer Th-1 should indicate a temperature between 59° and 61°C. provided that heater circuit power has been on the transmitter for at least three hours. A slight fluctuation of the thermometer reading of approximately plus or minus .1°C. may be noted, and is due to the cycling of the temperature control apparatus. Because the thermometer bulb is not in intimate contact with the frequency determining circuit parts and also because the thermometer is somewhat affected by the ambient temperature due to exposure of stem and scale, the thermometer reading is not generally an exact indication of the temperature of the circuit parts. If, however, the thermometer reading is between 58.5° and 61.5°C., it may be assumed that the frequency determining circuit parts are at their normal temperature as controlled by Thermostat S-13.

4-15 On A.C. equipments only, the master oscillator filament may be heated without operating the motor-generator unit. By heating the filament for an hour before operating the equipment, maximum frequency stability is obtained. M.O. filament Transformer T-12 located under the master oscillator compartment is used to supply filament power to the master oscillator tube when the set is in the stand-by condition. This keeps the master oscillator tube hot and reduces the frequency shift caused by the elements expanding when heated. T-12 is connected to the step-down Transformer T-15 terminals by M.O. FILAMENT STAND-BY POWER Switch S-27. Switch S-27 (found on A.C. equipments only) should be kept in the ON position at all times when the transmitter is required to operate within the next hour. By keeping the switch in the ON position the master oscillator filament voltage is automatically transferred to normal value when starting Contactor K-14 closes.

4-16 If extreme frequency stability is not desired, the standby power for the tube can be removed by setting Switch S-27 to the OFF position. When LOCAL-REMOTE Switch S-7 is placed in LOCAL position, Keying Relay K-1 and associate parts K-2, R-17, R-30 receive power for operation from the bias supply in the transmitter. A tap is taken from bias Potentiometers R-19, R-21 and R-28 at such a point that 115 volts D.C. appears between this tap and ground when the key is closed and the Transmitter is operated so as to give rated output. The actual circuit is from the bias potentiometer through keying relay series Resistor R-30 to terminal 19 on the terminal board. From terminal 19, the circuit passes through range switch Interlocks S-2A, S-9B and S-1C to terminal 20 on the terminal board. From terminal 20, the circuit goes to Relays K-1 and K-2 in parallel and then through TEST Key S-10 to ground which completes the circuit. The circuit is wired to terminals 19 and 20 on the terminal board to provide a means for circuit checking in case trouble arises in the keying circuit and if necessary, to short circuit Switch Interlocks S-2A, S-9B, S-1C in an emergency.

4-17 In the 115 V. D.C. transmitter, it is possible, by means of link Switch S-20, to connect the keying relay circuits across the 115 V. D.C. supply line. See Fig. 30, Dwg. W-7300716.

4-18 In the 230 V. D.C. transmitter, it is also possible by means of Switch S-20, to connect the keying relay circuits across a potentiometer consisting of R-36 and R-29 which is connected across the 230 V. D.C. supply line. See Fig. 30, Dwg. W-7300716.

4-19 After the motor-generator, magnetic controller, modulator and transmitter have been installed and preliminary tests completed, the calibration and further check on the operation of equipment should be effected as follows:

4-20 Close access doors of the Radio Transmitter Unit, Magnetic Controller and Modulator Unit.

4-21 Set transmitter controls as follows:

(a) Set START-STOP Switch S-8, S-17 to STOP.
(b) Set LOCAL-REMOTE Switch S-7 to LOCAL.
(c) Set TUNE-OPERATE Switch S-9 to TUNING STEP 1.
(d) Set EMERGENCY SWITCH S-12 to ON.
(e) Refer to the Table of Typical Dial and Tap Settings Fig. 56 and Test Data which accompanies this equipment and set Tuning Controls "A", "B", "C", "D", "E", "F", "G", "H", "J", "K", "L" to the approximate frequency desired.

(f) The frequency standard that is to be used to calibrate the transmitter should be started and set to desired frequency. This frequency standard can be any type of heterodyne frequency meter used in the Service that is capable of giving beats on the fundamental frequencies of 2000 to 4525 Kcs. Due to the frequency stability of the transmitter, it is only necessary to set the master oscillator to the desired frequency by the frequency standard. Then, adjust the intermediate amplifiers, power amplifier and antenna tuning circuits to resonance. The audio output from the frequency standard is available at the FREQUENCY METER AUDIO OUTPUT Jack, J-1, which will facilitate calibration.

(g) R.F. coupling terminals are provided on the transmitting unit for connection to the frequency standard. Approximately 15 millivolts of R.F. is available at these terminals, at the Master Oscillator output frequency providing the DOUBLER CIRCUIT TUNING (Control C.) is tuned.

4-22 The R.F. voltage is provided by coupling Capacitor C-68. This capacitor consists of an adjustable band around the grid terminal stand-off insulator of the first intermediate amplifier Tube VT-2. The band provides capacity coupling to the grid lead of the first intermediate amplifier tube. By moving this band up and down the stand-off insulator, the amount of coupling or R.F. pick-up voltage can be varied to suit individual installation conditions. By moving it closer to the top, or the grid terminal end of the insulator, the pick-up voltage is increased. If the band is moved away from the grid terminal end, towards ground, the pick-up voltage is decreased. Normally, it is set approximately ½ inch from the grid terminal end of the insulator which gives sufficient pick-up for most installations. If adjustment of Capacitor C-68 is found necessary, it should be locked securely in place after the adjustment has been made.

4-23 Apply 3000 volts plate voltage and filament power, starting the motor-generator by means of START-STOP Switch S-8, S-17. Check FILAMENT VOLTAGE Meter M-11 and adjust if necessary to 10 volts by means of FILAMENT VOLTAGE Rheostat R-6. Set frequency (Control A and B) to desired frequency.

4-24 Operate TEST Key S-10. The M.O. PLATE CURRENT Meter M-7 and M.O. SCREEN GRID CURRENT Meter M-8 should indicate current of about 60 and 11 ma., respectively.

4-25 Set TUNE-OPERATE Switch S-9 to TUNING STEP 2 and adjust Rheostat R-33 until M-9 reads 2000 volts. Operate TEST Key S-10 and adjust DOUBLER CIRCUIT TUNING (Control C) C-14 for maximum indication on Meter M-6 (approximately 68 ma.).

4-26 Adjust 1st INTERMEDIATE AMPLIFIER TUNING (Control D) C-21 for minimum indication on Meter M-6 or maximum indication on Meter M-5 (approximately 25 ma. on M-6 or 25 ma. on M-5).

4-27 Adjust 2nd INTERMEDIATE AMPLIFIER TUNING (Control E) L-9 for minimum indication on 2ND INT. AMP. PLATE CURRENT Meter M-4 or for maximum indication on P.A. GRID CURRENT Meter M-3 (approximately 50 ma. on M-4 or 60 ma. on M-3).

4-28 Adjust POWER AMPLIFIER TUNING (Control F) L-14 for minimum indication on P.A. PLATE CURRENT Meter M-2.

4-29 If the antenna is under 50 feet long or over 80 feet long, set ANTENNA FEED Switch S-6 to CURRENT FEED. If between 50 and 80 feet in length, set ANTENNA FEED Switch S-6 to VOLTAGE FEED. (The dimensions are only approximate.)

4-30 If ANTENNA FEED Switch S-6 is in the CURRENT FEED position, set ANTENNA TUNING INDUCTANCE (Control K) L-13 to 0 and adjust ANTENNA TUNING CAPACITOR (Control J) C-42 for maximum output as indicated on ANTENNA CURRENT Meter M-1.

4-31 If the P.A. PLATE CURRENT Meter M-2 indicates over 150 milliamperes, reduce the ANTENNA COUPLING (Control H) C-41 and retune the antenna system as in paragraphs 4-29 and 4-30.

4-32 Set TUNE-OPERATE Switch S-9 to OPERATE and adjust Rheostat R-33 until PLATE VOLTAGE Meter M-9 indicates 3000 volts. Close S-10 and readjust ANTENNA TUNING CAPACITOR (Control J) C-42 for maximum output as indicated on ANTENNA CURRENT Meter M-1. At the same time, adjust ANTENNA COUPLING (Control H) C-41, if necessary, to keep P.A. PLATE CURRENT Meter M-2 to a value *not in excess of 350 milliamperes.* It may also be necessary to slightly readjust POWER AMPLIFIER TUNING (Control F) L-14 for minimum value on P.A. PLATE CURRENT Meter M-2 due to antenna

effects. Optimum efficiency is the condition giving maximum indication on ANTENNA CURRENT Meter M-1 with minimum indication on P.A. PLATE CURRENT Meter M-2. Refer to Fig. 57 or Test Data which accompanied this transmitter unit for typical meter readings which were taken with the TUNE-OPERATE SWITCH S-9 on OPERATE.

4-33 NOTE: In order to resonate the antenna, it may be necessary to try various combinations of ANTENNA TUNING INDUCTANCE (Control K) L-13 and CAPACITOR (Control J) C-42, or VOLTAGE or CURRENT FEED to the antenna, to obtain maximum output without the power amplifier being overloaded.

4-34 When operating the transmitter on low power with HIGH-LOW POWER Switch S-5 in the LOW POWER position, the Radio Transmitting Unit should be tuned as described. However, the following exceptions must be observed: The POWER AMPLIFIER TUNING (Control F) L-14 and the P.A. GRID CURRENT Meter M-3 is omitted. The ANTENNA COUPLING (Control H) C-41 is so adjusted that the second intermediate amplifier (now used as a final amplifier) 2ND INT. AMP. PLATE CURRENT Meter M-4 *does not exceed 150 Milliamperes.* It is to be recalled that the upper limiting frequency is 9050 Kcs. in the LOW POWER position.

4-35 The PLATE VOLTAGE Meter M-9 should not exceed 3000 volts when using either HIGH or LOW POWER. This can be adjusted by the PLATE VOLTAGE Rheostat R-33 on the Radio Transmitter Unit. The 2000 volt armature of the high voltage generator unit is used to apply plate voltage (2100 volts maximum) to the Type 860 tubes first and second intermediate amplifier stages. This voltage is indicated on PLATE VOLTAGE Meter M-9 on the Radio Transmitter Unit when TUNE-OPERATE Switch S-9 is on STEP 2. The PLATE VOLTAGE Meter indicates the voltage which would be applied to the plate of the Type 861 Tube if the HIGH-LOW POWER Switch S-5A was on HIGH POWER.

4-36 After having tuned the Radio Transmitter Unit as described, it can be started, keyed and stopped from a remote position by throwing the LOCAL-REMOTE Switch S-7 to the REMOTE position. When the remote control unit is used, the START-STOP Switch S-8 on the Radio Transmitter Unit must be in the START position. The Radio Transmitter Unit can always be stopped by the local START-STOP Switch S-8, S-17 since this is supervisory over the remote starting switch.

C. Routine Operation, Transmitter

4-37 Assuming that the transmitter unit has been calibrated for all of the desired operating frequencies and that the master oscillator heater compartment is at operating temperature, routine operation may be accomplished as follows:

(a) *To start and stop the equipment (assuming that the tuning is correct).*

For local control, place LOCAL-REMOTE Switch S-7 to LOCAL. The equipment is then started or stopped by means of START-STOP Switch S-8, S-17. For remote control of TBM-11 equipment, place LOCAL-REMOTE Switch S-7 in the REMOTE position. Place START-STOP Switch S-8 in START position. Place EMISSION Switch S-405 on Modulator Unit to Voice, CW or MCW position as desired. The equipment can be controlled from a 4- or 6-wire remote control unit and/or a Type CRV-23172 or Type CRV-23211 Radiophone Unit.

(b) *To Change Frequency*

Return control to LOCAL point by placing LOCAL-REMOTE Switch S-7 in LOCAL position for the duration of tuning period.

Open TEST Key S-10.

Set TUNE-OPERATE Switch S-9 to TUNING STEP 2.

Set Controls A to L according to calibration chart, for the desired frequency.

If operating conditions permit, close TEST Key S-10 and note that P.A. PLATE CURRENT Meter M-2 indicates between 150 and 250 ma. Set TUNE-OPERATE Switch S-9 to OPERATE. With key closed, all meters should indicate normally.

(c) *To Increase or Decrease Power*

To decrease power, rotate generator field Rheostat R-33 counterclockwise until the desired reduction is obtained. When phone transmission is being used, the SPEECH GAIN Control R-401 in the Modulator Unit must be set to reduce the gain of the Modulator Unit. Quarter power can be obtained by this method.

To increase power rotate the generator field Rheostat R-33 clockwise until desired power is obtained. When phone transmission is being used, SPEECH GAIN Control R-401 in the Modulator must be set to increase gain. Do not exceed 3000 volts, as indicated by PLATE

VOLTAGE Meter M-9. If power less than quarter normal is desired, place HIGH-LOW POWER Switch S-5 to LOW position and set Controls E, H, J, K, as calibrated for LOW power. This mode of operation is available for output frequencies between 2000 and 9050 kcs., for CW telegraph transmission.

D. Modulator, Operation

4-38 Although the transmitter may be operated independently of the modulator, when they are connected together, the mode of transmission is selected by CW-MCW-VOICE Switch S-405, which is located on the modulator. When the CW-MCW-VOICE Switch S-405 is turned to either MCW or VOICE position, a resistor is inserted in the 3000 volt plate lead to reduce the transmitter power amplifier plate voltage to the proper value for modulation (2700 V.). It is also necessary at the same time to readjust the power amplifier output coupling, so that approximately 70% of rated CW output power (350 Watts) is obtained at this low value of plate voltage without modulation. Current input to the power amplifier plates should be 270 ma. at 2700 volts when output power is 350 Watts. CW-MCW-VOICE Switch should be in the VOICE position and all audio voltage from the line input to the modulator should be removed before attempting this adjustment.

E. Placing Modulator in Operation for the First Time

4-39 In the following it must be assumed that the radio transmitter is connected and placed in operation. The modulator is started simultaneously with the transmitter by means of START-STOP Switch S-8. It can also be remotely started by a similar switch on the Navy Type 23005 standard 4-wire remote control unit or Type 23146 standard 6-wire remote control unit which is located on the operator's desk. When Radiophone Units Navy Type CRV-23172 or CRV-23211 are used, the transmitter and modulator may also be started and stopped from these units.

(a) *MCW Operation*

4-40 Turn CW-MCW-VOICE Switch S-405 on the Modulator Unit to VOICE. Turn carrier on with transmitter TEST Key S-10. Readjust transmitter power amplifier coupling so that 70% of normal output on CW is obtained with 270 ma. plate input current to the power amplifier. Turn the CW-MCW-VOICE Switch to MCW and key as desired. MCW modulation Control R-409 has been set at the factory for 100% modulation and should require no adjustment. Check meter readings per the left-hand column of the following table:

Typical Meter Readings

Meter			MCW Modulation Key Up	MCW Modulation Key Down	Voice Modulation Manual - Automatic Gain Switch in Manual Position 0% Modulation	Voice Modulation Manual - Automatic Gain Switch in Manual Position 100% Modulation
INPUT AMPL. PLATE CURRENT Meter	M-401	(ma.)	0	0	3	3
INT. AMPL. PLATE CURRENT Meter	M-402	(ma.)	120	130	120	140
MODULATOR PLATE CURRENT Meter	M-403	(ma.)	50	160	50	160
MODULATOR PLATE CURRENT Meter	M-404	(ma.)	50	160	50	160
PERCENTAGE MODULATION Meter	M-405	(%)	60	60	0	100
FILAMENT VOLTAGE Voltmeter	M-406	(Volts)	10	10	10	10

4-41 Note: PERCENTAGE MODULATION Meter M-405 is short-circuited during MCW operation and is, therefore, inoperative. When this meter is inoperative, it does not read zero but somewhere near mid-scale. This is the condition also with CW-MCW-VOICE Switch S-405 in the VOICE position, but with no carrier or modulation. When carrier is applied with no modulation, the meter reads zero.

4-42 The Type CAY-50065-A Modulator Unit is used as a part of a number of different equipments, some of which provide vacuum tube keying. To prevent improper operation, a warning appears on the nameplate of CW-MCW-VOICE Switch S-405 that in the MCW position, vacuum tube keying should not be used.

4-43 While it is not necessary to select special tubes for the operation of the modulator, it is advisable to discard those with characteristics which through long life, abuse, or other causes differ considerably from the specification requirements of the particular tube. In order that the distortion may be reduced to a minimum, it is desirable that the tubes which operate in opposite sides of the push-pull amplifier (VT-405 and VT-406) be similar. This

makes it desirable to select tubes of approximately equal mutual conductance whenever this selection may be made conveniently. In the case of the Type 803 tubes used as modulators, a check on their similarity may be had by referring to above table.

(b) *Voice Operation*

4-44 Adjust radio transmitter power amplifier coupling as described in (a) MCW. Leave CW-MCW-VOICE Switch S-405 in VOICE position. Remove Handset HS-401 from microphone hook. Place CARRIER CONTROL Switch S-403 in MANUAL position. Press the Press-to-Talk switch and talk into microphone. Adjust SPEECH GAIN Attenuator R-401 until PERCENTAGE MODULATION Meter M-405 indicates that the transmitter is being modulated. The microphone should be held approximately one inch from the mouth and spoken into with a normal conversation tone.

4-45 SPEECH GAIN Attenuator R-401 should be increased only to the point sufficient to obtain approximately 60% modulation when the syllable "Ah" is spoken into the test microphone of Handset HS-401. Owing to the wave shape of most speech syllables, Meter M-405 will indicate considerable less than 100% modulation under ordinary operation even though the instantaneous power values may somewhat exceed 100% modulation.

4-46 Care should be taken to see that the Meters M-403, M-404, and M-405 do not materially exceed the values given in the above table during normal operation. It is advisable not to exceed 100% modulation during ordinary operation in order to avoid the distortion which inevitably results from over-modulation. The most satisfactory method of determining the exact setting for satisfactory modulation is by listening to the recified radio frequency signal locally or by obtaining reports from a distant receiving station.

4-47 Whenever Handset HS-401 is used for modulation purposes, it is necessary to press the Press-to-Talk switch before talking. This switch controls the transmitter carrier power through Relay K-401 and the transmitter keying relay. It prevents modulation or emission of any sort unless it is pressed. Its function is duplicated by TALK Switch S-404, which may be used instead.

4-48 When the equipment is operating satisfactorily as adjusted above, CARRIER CONTROL Switch S-403 should be placed in VOICE RELAY position. R-413 should be advanced to approximately 3 on the dial. When the microphone is spoken into, Meter M-405 and Meters M-403 and M-404 should indicate approximately the same as in the table Par. 4-40. Under VOICE RELAY condition, it is still necessary to press the Press-to-Talk button or place Switch S-404 to TALK when using the local microphone for modulation. However, when modulation is derived from one of the remotely located speech input equipments, the voice relay circuit automatically puts the transmitter into operation, and removes carrier power after modulation ceases without any manual operations. The exact position of R-413 for best operation may be determined by remote reception tests as in the case of SPEECH GAIN Attenuator R-401 above. When necessary, it may be adjusted by observations made on a local receiver. By adjustment of R-413, carrier can be obtained in approximately 0.025 second after starting to talk into the microphone. This minute fraction is approximately the time required to pronounce the letter "i" in the word "it". With correct adjustment, normal room noises in the vicinity of the microphone should not cause the voice relay to operate, although speaking into the microphone in normal conversational tone with the speaker's lips one inch from the microphone will operate the relay.

4-49 It should be remembered that with Switch S-403 in VOICE RELAY position, radiation occurs whenever the microphone is spoken into, without the manual operation of any switches. When VOICE RELAY SENSITIVITY Attenuator R-413 is advanced toward maximum, extraneous noises near the microphone may cause undesired transmission. If this occurs to an objectional degree, sensitivity should be reduced or manual operation from the remote speech input equipment may be substituted by changing CARRIER CONTROL Switch S-403 to MANUAL position. With the local microphone in use, R-413 should be turned up to 3 or 4 on the dial. With remote speech input, it may be turned up beyond the mid-position as far as noise conditions will permit.

(c) *Controls*

4-50 In the above description of operation of the MCW and VOICE features of the modulator, mention was made to the panel TALK Switch S-404. This switch is used for the purpose of controlling the carrier directly from the panel. It has three positions: (1) The lower or local position which gives sustained carrier output, (2) The upper or

momentary position which may be used to intermittently open or close the transmitter keying relay and thereby operate like a key, and (3) The center or OFF position, in which carrier is off. Both upper and lower TALK positions energize the local microphone when it is off the hook, and duplicate the function of the Press-to-Talk switch. This switch does not control carrier when Switch S-403 is in the VOICE RELAY position. Operation of TALK Switch S-404 is therefore dependent upon the settings of CARRIER CONTROL Switch S-403 and on the microphone hook. It is possible by means of these various controls to obtain the following operations.

CARRIER CONTROL Switch S-403 in MANUAL position

1. Local handset in place on hook.
   (a) Control and modulate carrier from Navy Types CW-23071-2 speech input equipments; or Radiophone Units, Type CRV-23172 or CRV-23211.
   (b) Control carrier with panel TALK Switch S-404 (either momentary or locked position).
2. Local handset removed from hook.
   (a) Control and modulate carrier from local handset (by use of Press-to-Talk button).
   (b) Control carrier and energize local microphone by operation of panel TALK Switch S-404 (either momentary or locked position).

CARRIER CONTROL Switch S-403 in VOICE RELAY position

1. Local handset in place on hook.
   (a) Carrier controlled by proper audio level in 600 ohm modulator input circuit.
   (b) Position of panel TALK Switch S-404 does not affect operation as per (a) above.
2. Local handset removed from hook.
   (a) Carrier controlled by proper audio level in modulator input circuit (audio voltage derived from local microphone; 600 ohm input circuits from remote units opened by hook switch.)
   (b) Local microphone may be energized by operation of handset Press-to-Talk button or panel TALK Switch S-404 in either momentary or locked position, but carrier is controlled only when microphone is spoken into.

(d) Automatic Gain Operation

4-51 It is always desirable in a communication system to utilize the available power to the maximum of its capability. To this end, volume controls such as R-401 are used for the purpose of manually maintaining the percentage modulation as high as possible for different levels of speech input. It is sometimes desirable to accomplish the same end automatically, to relieve the operator of the necessity of watching the volume closely and to make the modulated output less subject to human variables. Automatic operation of this type is achieved through the medium of MANUAL-AUTOMATIC GAIN Switch S-402, when placed to the AUTOMATIC position.

4-52 When MANUAL-AUTOMATIC GAIN Switch S-402 is placed to AUTOMATIC position, automatic gain operation is effected by Tube VT-409 (Type 25Z5) in conjunction with Tubes VT-401 and VT-402. Tubes VT-401 and VT-402 are of the so-called super control type. The gain of these tubes is very sensitive to changes in grid bias, a fact which makes them suited for the purpose of automatic gain control. Audio voltage from one of the windings of Transformer T-404 is applied through Potentiometer R-432 to the left-hand plate of Tube VT-409. This action increases or decreases the negative grid bias on Tubes VT-401 and VT-402 up to the level corresponding to 100% modulation of the transmitter. From very low audio levels, up to that corresponding to 100% modulation of the transmitter, Tube VT-409 acts as a compressor to increase the gain for small signals. Thus for minus 35 DB. input, the gain is increased approximately 17½ DB. more than the gain for zero DB. input.

4-53 Beyond 100% modulation, Tube VT-409 acts as a limiter. The voltage from the same winding of Transformer T-404 is now of such a value to override a predetermined bias on the right hand plate of Tube VT-409. This will apply additional negative bias to the grids of Tubes VT-401 and VT-402. A check on the operation of the automatic gain feature is obtained as follows: Place MANUAL-AUTOMATIC GAIN Switch S-402 to the AUTOMATIC position. Turn SPEECH GAIN Attenuator R-401 to obtain minimum attenuation, or to 20 on the dial. Now, apply a steady tone into the microphone such as a whistle, starting softly and gradually increasing in loudness until about 80% modulation is shown on Meter M-405. While maintaining this note, turn SPEECH GAIN Attenuator R-401 to 12

on the dial. If the automatic gain is working correctly, the percentage modulation should drop to approximately 40%. If Switch S-402 were placed to MANUAL position, for the same gain reduction, Meter M-405 would drop to approximately 20%.

F. Routine Operation, Modulator

4-54 After preliminary adjustments have been completed, it should not be necessary to operate the controls except for test or for change in operating conditions. CARRIER CONTROL Switch S-403 will be left at either one of the two control positions, VOICE RELAY or MANUAL, depending upon which kind of control is desired. Voice Relay K-401 in conjunction with the voice relay tube circuit, functions entirely automatically. As in the case of many other fully automatic devices, it may be desirable at times to control the transmitter unit manually as by a key. At such times, CARRIER CONTROL Switch S-403 may be placed to the MANUAL position. Again, it may be desirable to disconnect control from the remote speech input equipment by removing Handset HS-401, or by placing CARRIER CONTROL Switch S-403 to MANUAL and TALK Switch S-404 to OFF. This makes it possible for the operator stationed at the modulator to cut off any one talking at a remote position if it is so desired. The most important things to remember in connection with this switch are that (1) while CARRIER CONTROL Switch S-403 is thrown to the VOICE RELAY position, and with power supplied to the equipments, radiation occurs whenever sound waves enter any remotely connected microphone without manual operation of any switches; (2) when Switch S-403 is in the MANUAL position, it is always necessary to energize the carrier before speaking into a microphone, or no transmission will be effected.

4-55 Carrier power cannot be controlled (turned on and off) from the modulator unless transmitter REMOTE-LOCAL Switch S-7 is in the REMOTE position. With 4-wire control, it is impossible to start the motor-generator set unless the controller circuit is completed in the 4-wire Remote Control Unit Navy Type 23005 or Radiophone Unit Navy Type CRV-23172. Additionally, it is impossible to check performance, during VOICE operation, from the modulator test handset unless REMOTE LOCAL Switch S-7 is in REMOTE position. These conditions might lead to difficulties, since in REMOTE operation the Radiophone Unit indicator lights give the remote operator the impression that the equipment is ready for operation, causing him to attempt to use the equipment while the local operator was making adjustments. This difficulty can be eliminated as follows: Place REMOTE-LOCAL Switch S-7 to LOCAL, lock transmitter TEST Key S-10 and use modulator Handset HS-401 Press-to-Talk switch to operate the modulator. Thus, the equipment can be completely adjusted under LOCAL control, and switched to REMOTE after adjustments are completed. The CARRIER ON indicator lights on all connected Radiophone Units, are energized whenever the Press-to-Talk switch on any one Radiophone Unit is pressed, even though the transmitter is under LOCAL control, and is not available to remote operators. However, under LOCAL control, the POWER indicator lights on the Radiophone Units do not light when the Press-to-Talk switches on these units are pressed.

4-56 The modulator should always be operated with filament voltage at the correct value of 10 volts. Too high or too low voltage will cause damage to vacuum tubes. Voltage may be adjusted by means of Rheostat R-415 and is indicated on Meter M-406.

4-57 If the equipment is operated on reduced power it is important to readjust R-401 before returning to full power operation. Otherwise, overmodulation and the accompanying distortion will result. Meter M-405 should be watched to guard against this.

4-58 The modulator is inoperative when the transmitter is used at 75 watts output from the intermediate amplifier, with the power amplifier not functioning. Therefore, CW emission only is available. CW-MCW-VOICE Switch S-405 should always be in the CW position, during this mode of transmission.

4-59 It is unnecessary to readjust tap settings on Resistors R-414, R-419, R-420, and R-421. Since there is zero bias on vacuum tubes VT-405 and VT-406 it is unnecessary to make any adjustments in the grid circuit of these tubes. Any plate current unbalance up to $\pm 15\%$ is permissible and should cause no concern. The transmitter power amplifier plate current should be maintained at the proper value of 270 milliamperes and the plate voltage at 2700 volts when CW-MCW-VOICE Switch S-405 is in either the VOICE or MCW position.

4-60 All meter readings should be approximately in accordance with the table given in Paragraph 4-40 when the equipment is in normal operation. In

momentary position which may be used to intermittently open or close the transmitter keying relay and thereby operate like a key, and (3) The center or OFF position, in which carrier is off. Both upper and lower TALK positions energize the local microphone when it is off the hook, and duplicate the function of the Press-to-Talk switch. This switch does not control carrier when Switch S-403 is in the VOICE RELAY position. Operation of TALK Switch S-404 is therefore dependent upon the settings of CARRIER CONTROL Switch S-403 and on the microphone hook. It is possible by means of these various controls to obtain the following operations.

CARRIER CONTROL Switch S-403 in MANUAL position

1. Local handset in place on hook.
   (a) Control and modulate carrier from Navy Types CW-23071-2 speech input equipments; or Radiophone Units, Type CRV-23172 or CRV-23211.
   (b) Control carrier with panel TALK Switch S-404 (either momentary or locked position).
2. Local handset removed from hook.
   (a) Control and modulate carrier from local handset (by use of Press-to-Talk button).
   (b) Control carrier and energize local microphone by operation of panel TALK Switch S-404 (either momentary or locked position).

CARRIER CONTROL Switch S-403 in VOICE RELAY position

1. Local handset in place on hook.
   (a) Carrier controlled by proper audio level in 600 ohm modulator input circuit.
   (b) Position of panel TALK Switch S-404 does not affect operation as per (a) above.
2. Local handset removed from hook.
   (a) Carrier controlled by proper audio level in modulator input circuit (audio voltage derived from local microphone; 600 ohm input circuits from remote units opened by hook switch.)
   (b) Local microphone may be energized by operation of handset Press-to-Talk button or panel TALK Switch S-404 in either momentary or locked position, but carrier is controlled only when microphone is spoken into.

(d) *Automatic Gain Operation*

4-51 It is always desirable in a communication system to utilize the available power to the maximum of its capability. To this end, volume controls such as R-401 are used for the purpose of manually maintaining the percentage modulation as high as possible for different levels of speech input. It is sometimes desirable to accomplish the same end automatically, to relieve the operator of the necessity of watching the volume closely and to make the modulated output less subject to human variables. Automatic operation of this type is achieved through the medium of MANUAL-AUTOMATIC GAIN Switch S-402, when placed to the AUTOMATIC position.

4-52 When MANUAL-AUTOMATIC GAIN Switch S-402 is placed to AUTOMATIC position, automatic gain operation is effected by Tube VT-409 (Type 25Z5) in conjunction with Tubes VT-401 and VT-402. Tubes VT-401 and VT-402 are of the so-called super control type. The gain of these tubes is very sensitive to changes in grid bias, a fact which makes them suited for the purpose of automatic gain control. Audio voltage from one of the windings of Transformer T-404 is applied through Potentiometer R-432 to the left-hand plate of Tube VT-409. This action increases or decreases the negative grid bias on Tubes VT-401 and VT-402 up to the level corresponding to 100% modulation of the transmitter. From very low audio levels, up to that corresponding to 100% modulation of the transmitter, Tube VT-409 acts as a compressor to increase the gain for small signals. Thus for minus 35 DB. input, the gain is increased approximately 17½ DB. more than the gain for zero DB. input.

4-53 Beyond 100% modulation, Tube VT-409 acts as a limiter. The voltage from the same winding of Transformer T-404 is now of such a value to override a predetermined bias on the right hand plate of Tube VT-409. This will apply additional negative bias to the grids of Tubes VT-401 and VT-402. A check on the operation of the automatic gain feature is obtained as follows: Place MANUAL-AUTOMATIC GAIN Switch S-402 to the AUTOMATIC position. Turn SPEECH GAIN Attenuator R-401 to obtain minimum attenuation, or to 20 on the dial. Now, apply a steady tone into the microphone such as a whistle, starting softly and gradually increasing in loudness until about 80% modulation is shown on Meter M-405. While maintaining this note, turn SPEECH GAIN Attenuator R-401 to 12

on the dial. If the automatic gain is working correctly, the percentage modulation should drop to approximately 40%. If Switch S-402 were placed to MANUAL position, for the same gain reduction, Meter M-405 would drop to approximately 20%.

F. Routine Operation, Modulator

4-54 After preliminary adjustments have been completed, it should not be necessary to operate the controls except for test or for change in operating conditions. CARRIER CONTROL Switch S-403 will be left at either one of the two control positions, VOICE RELAY or MANUAL, depending upon which kind of control is desired. Voice Relay K-401 in conjunction with the voice relay tube circuit, functions entirely automatically. As in the case of many other fully automatic devices, it may be desirable at times to control the transmitter unit manually as by a key. At such times, CARRIER CONTROL Switch S-403 may be placed to the MANUAL position. Again, it may be desirable to disconnect control from the remote speech input equipment by removing Handset HS-401, or by placing CARRIER CONTROL Switch S-403 to MANUAL and TALK Switch S-404 to OFF. This makes it possible for the operator stationed at the modulator to cut off any one talking at a remote position if it is so desired. The most important things to remember in connection with this switch are that (1) while CARRIER CONTROL Switch S-403 is thrown to the VOICE RELAY position, and with power supplied to the equipments, radiation occurs whenever sound waves enter any remotely connected microphone without manual operation of any switches; (2) when Switch S-403 is in the MANUAL position, it is always necessary to energize the carrier before speaking into a microphone, or no transmission will be effected.

4-55 Carrier power cannot be controlled (turned on and off) from the modulator unless transmitter REMOTE-LOCAL Switch S-7 is in the REMOTE position. With 4-wire control, it is impossible to start the motor-generator set unless the controller circuit is completed in the 4-wire Remote Control Unit Navy Type 23005 or Radiophone Unit Navy Type CRV-23172. Additionally, it is impossible to check performance, during VOICE operation, from the modulator test handset unless REMOTE LOCAL Switch S-7 is in REMOTE position. These conditions might lead to difficulties, since in REMOTE operation the Radiophone Unit indicator lights give the remote operator the impression that the equipment is ready for operation, causing him to attempt to use the equipment while the local operator was making adjustments. This difficulty can be eliminated as follows: Place REMOTE-LOCAL Switch S-7 to LOCAL, lock transmitter TEST Key S-10 and use modulator Handset HS-401 Press-to-Talk switch to operate the modulator. Thus, the equipment can be completely adjusted under LOCAL control, and switched to REMOTE after adjustments are completed. The CARRIER ON indicator lights, on all connected Radiophone Units, are energized whenever the Press-to-Talk switch on any one Radiophone Unit is pressed, even though the transmitter is under LOCAL control, and is not available to remote operators. However, under LOCAL control, the POWER indicator lights on the Radiophone Units do not light when the Press-to-Talk switches on these units are pressed.

4-56 The modulator should always be operated with filament voltage at the correct value of 10 volts. Too high or too low voltage will cause damage to vacuum tubes. Voltage may be adjusted by means of Rheostat R-415 and is indicated on Meter M-406.

4-57 If the equipment is operated on reduced power it is important to readjust R-401 before returning to full power operation. Otherwise, overmodulation and the accompanying distortion will result. Meter M-405 should be watched to guard against this.

4-58 The modulator is inoperative when the transmitter is used at 75 watts output from the intermediate amplifier, with the power amplifier not functioning. Therefore, CW emission only is available. CW-MCW-VOICE Switch S-405 should always be in the CW position, during this mode of transmission.

4-59 It is unnecessary to readjust tap settings on Resistors R-414, R-419, R-420, and R-421. Since there is zero bias on vacuum tubes VT-405 and VT-406 it is unnecessary to make any adjustments in the grid circuit of these tubes. Any plate current unbalance up to $\pm 15\%$ is permissible and should cause no concern. The transmitter power amplifier plate current should be maintained at the proper value of 270 milliamperes and the plate voltage at 2700 volts when CW-MCW-VOICE Switch S-405 is in either the VOICE or MCW position.

4-60 All meter readings should be approximately in accordance with the table given in Paragraph 4-40 when the equipment is in normal operation. In

case of doubt, it is desirable to move TALK Switch S-404 to TALK position and CARRIER CONTROL Switch S-403 to MANUAL. Then observe that all meter indications are normal. In doing this, care must be taken not to interrupt conversations from the remote speech input equipment or unnecessarily cause interference contrary to communication regulations.

4-61 It is desirable that Meter M-405 be occassionally observed during transmission, and R-401 adjusted if necessary. Before adjusting this control, the operator should assure himself that the audio levels from the remote speech input equipment are correct. Approximately 0.4 milliwatt audio level is necessary for 100% modulation. This 0.4 milliwatt refers to the input level to Terminals 1 and 2 of the modulator.

4-62 The approximate performance of the Modulator is given below:

Audio Input	0.4 milliwatt
Filament Power	200 va.
From 300 Volt Screen Supply	75 ma.
From 40 Volt Suppressor	10 ma.
2000 Volt Plate Supply	320 ma.
From 275 Volt Exciter Supply	400 ma.
Output Percent Modulation	100%
Output in Audio Watts to Plate of Radio Transmitter	365 watts
Output to Screens of Radio Transmitter Power Amplifier	10 watts
Audio Power Gain, Volume Control Minimum	30 DB.
Audio Power Gain, Volume Control Maximum	60 DB.
Fidelity (100 to 5000 cycles)	±2 DB.
Distortion—10% at 95% Modulation	
Voice Relay Start, Minimum Time Required	.025 sec.
Voice Relay Stop, Maximum Time Required	0.2 sec.

4-63 When using the local microphone on Handset HS-401 remember that removing this handset from its hook disconnects the incoming 600 ohm audio line, and disconnects any speech coming over this line into the modulator. The volume of input to the receiver of Handset HS-401 is controlled by RECEIVER VOLUME Attenuator R-429 which is mounted on the front panel.

4-64 MANUAL-AUTOMATIC GAIN Switch S-402 should be placed to the position corresponding to the mode of operation desired; that is, to AUTOMATIC in case automatic gain control is desired, or to MANUAL in case it is desired to control the gain manually.

G. Motor-Generator and Magnetic Controller Operation

4-65 In the following text refer to Figures 29 and 30, Dwgs. W-7300717 and W-7300716, depending upon the power supply being used.

4-66 The sequence of control for applying power to the transmitter equipment is as follows. Refer also to paragraph 4-37.

(a) Closing power line Switch S-801, S-831, or S-821, in the magnetic controller applies power to the transmitter for operation of the master oscillator heat control system. In the case of D.C. equipments, this power is at the voltage of the supplying line and appears at Terminals 9 and 10 on the transmitter. The power is used for operation of the master oscillator heat control system and the transmitter control circuit. For A.C. equipments the power is applied to the transmitter at Terminals 38 and 39 at the normal voltage of the supply line. This voltage is transformed to 110 volts by Transformer T-14 for operation of the master oscillator heat control system and for the control circuits.

(b) The master oscillator heat control system and control circuits are protected by Fuses F-1 and F-2. These fuses are connected in the lines from Terminals 9 to 10 in D.C. transmitter units and in the primary circuit of the Transformer T-14 in the A.C. transmitter units.

(c) To start the motor-generator unit, place LOCAL-REMOTE Switch S-7 to LOCAL and START-STOP Switch S-8, S-17 to START. If EMERGENCY SWITCH S-12, Door Interlocks S-14, S-15, S-16 and master oscillator plate overload Relay, K-7, are all closed, operation of the START-STOP Switch S-8, S-17 will close starting Contactor K-14, K-4.

(d) Closing of Contactor K-14, K-4 energizes Contactor K-19, K-9 by action of contacts K-14E, K-4E, provided main plate overload Relay K-5 is closed. Closing of Contactor K-14,K-4 and Contactor K-19, K-9 takes place almost simultaneously, and the motor start indicator Light I-2 (Red) and the plate ON indicator Light I-3 (Red) will light.

(e) Closing of Contactor K-19, K-9 connects the high voltage generator field to the terminals of the bias generator through generator field Rheostat R-33. It also connects the low voltage generator field to these same terminals through

Resistor R-13. In this manner, the fields of the generators are connected across the bias generator armature when Contactor K-14, K-4 closes.

(f) As starting Contactor K-4 in the D.C. equipment closes, it also completes the magnetic controller solenoid circuit through contact K-4D, which starts the motor-generator. In the case of an A.C. equipment, the magnetic controller solenoid circuit is completed when contact K-14E, of starting Contactor K-14 closes. The controller solenoid coil is designed for a 110 volt circuit. Power for operating the magnetic controller solenoid is obtained from 110 volt supply from Transformer T-14, with the other control contactors. The magnetic controller will function properly after starting contactor K-14 has closed provided controller overload Relays K-862, K-844 or K-854 are closed.

(g) After magnetic controller Solenoid K-842A-M, K-852A-M has become energized, the action of the D.C. equipment controller is as follows: The main Contact K-842B, K-852B will open. It should be noted that Interlock K-841F, K-851F of Contactor K-841, K-851 will prevent Contactor K-842, K-852 from becoming energized unless Contactor K-841, K-851 is open. Interlock K-842C, K-852C will in turn energize main Coil K-843A, K-853A of Contactor K-843, K-853. Its main Contact K-843B, K-853B, will open, thereby inserting the whole starting Resistor R-841, R-851 in the motor circuit. Interlock contact K-843C, K-853C will close and complete the circuit to Coil K-841A, K-851A of line Contactor K-841, K-851. This will close an connect the motor to the line with the starting resistor in the circuit. The "make" Interlock K-841E, K-851E will close and seal Contactor K-841, K-851 on the line. The "break" Interlock K-841F, K-851F will open and de-energize contactor Coil K-842A-M, K-852A-M. The accelerating "break" Contact K-841D, K-851D will open and place more impedance in series with Coil K-841A, K-851A. The coil will not draw more current than is necessary to keep the armature sealed once it is pulled in. Contact K-842B, K-852B will remain open after K-842A-M, K-852A-M is de-energized because the holding Coil K-842A-H, K-852A-H has been energized by a portion of the current flowing through starting Resistor R-841, R-851. This is done by connecting control Resistor R-842, R-852 in parallel with the final portion of R-841, R-851 and then connecting holding Coil K-842A-H in parallel with R-842, R-852. When starting current flows through Resistor R-841, R-851, part of this current flows through R-842, R-852 and through Coil K-842A-H, K-852A-H. When the motor is at rest, this current is very large and enough flows through K-842A-H, K-852A-H to prevent Contact K-842B, K-852B from closing. As the motor speed increases the current through R-841, R-851 and K-842A-H, K-852A-H decreases. At some predetermined motor speed, the current through K-842A-H, K-852A-H becomes so small that the magnetic pull is not enough to hold the contactor armature in. The armature drops out and K-842B, K-852B closes. The motor speed at which K-842A-H, K-852A-H is de-energized is determined by the position of the tap from K-842A-H, K-852A-H to Resistor R-842, R-852. When main Contact K-842B, K-852B closes, it shorts out the first portion of R-841, R-851 and thus completes the first step of the starting cycle. Also, when K-842A-H, K-852A-H is de-energized, interlock Contact K-842C, K-852C will open, thus de-energizing main Coil K-843A-M, K-853A-M. Contact K-843B, K-853B will remain open after Coil K-843A-M, K-853A-M is de-energized, because K-843A-H, K-853A-H remains energized. Coil K-843A-H, K-853A-H is also connected in parallel with R-842, R-852. Since Resistor R-842, R-852 is in parallel with the final portion of R-841, R-851, the current in R-842, R-852 goes up again when Contact K-842B, K-852B shorts out the first section of Resistor B-841, R-851. When the current in R-842, R-852 rises, the current in holding Coil K-843A-H, K-853A-H also rises and Contact K-843B, K-853B remains open. At some predetermined motor speed, the current through K-843A-H, K-853A-H becomes so small that the contactor armature drops out and Contact K-843B, K-853B closes. When K-843B, K-853B closes, it shorts out the second or final step of R-841, R-851 and the motor armature is now connected directly across the full line voltage. The speed at which Coil K-843A-H, K-853A-H is de-energized is determined by the position of the tap from K-843A-H, K-853A-H to Resistor R-842, R-852. When Coil K-843A-H, K-853A-H is de-energized, interlock Contact K-843C, K-853C is opened. This contact is connected in parallel with K-841E,

K-851E. When Contactor K-841, K-851 was first energized, K-841E, K-851E closed and shorted out K-843C, K-853C and locked in Contactor K-841, K-851.

(h) Interlock Contact K-842D, K-852D is connected between Terminals T-1 and T-2 in the magnetic controller. This contact is in series with the tube filament supply from the slip rings on the motor. When Contactor K-842, K-852 is energized, K-842D, K-852D opens, thus opening the filament supply line. When K-842, K-852 is de-energized at the end of the first step, Contact K-842D, K-852D closes again and the filament supply line is closed and the filaments are lighted. When K-842D, K-852D closes, the motor has attained sufficient speed so that the filament transformer will not overload the circuits. Interlock Contact K-843D, K-853D is in series with keying relay Coil K-1A when 4-wire control is used. When K-843, K-853 is energized, K-843D, K-853D opens and remains open until Contactor K-843, K-853 is de-energized at the end of the second step. By this time the motor has come up to full speed and keying is prevented until the motor has reached proper speed.

(i) The motor will stop when START-STOP Switch S-8, S-17 is placed in the STOP position because one side of the line to line contactor Coil K-841A, K-851A is opened by Contact K-4D. Contactor K-841A, K-851A will be de-energized and disconnect the motor from the line. The motor will also stop if overload Relay K-844, K-854 trips or if the supply voltage fails. If the overload relay has tripped, the motor cannot be started until the relay has been reset.

(j) For A.C. equipment, the magnetic controller is of the ACROSS-THE-LINE type which means that line contactor Coil K-861 is energized by operation of the START-STOP Switch S-8, S-17 in the transmitter unit. The motor is connected directly to the supply line through Contact K-861B, C, and D. The motor will stop when Contactor K-861 is de-energized by operation of START-STOP Switch S-8, S-17. It will also stop if overload Relay K-862 trips and de-energizes Contactor K-861 by opening Contacts K-862C.

(k) Overload Relay K-862, will trip if the motor is overloaded continuously 20% or more, or if the motor is stalled. The relay has inherent time delay features providing for tripping which is inversely proportioned to the value of overload current.

V. Maintenance

A. General

5-1 Keeping the equipment in good operating condition is absolutely essential to proper performance. Becoming familiar with the design of any equipment is the first essential for obtaining optimum performance. The following points should be observed for this reason, as well as for safety reasons.

5-2 An accurate record should be kept on all vacuum tubes. This record should contain date of receipt, date placed in service, use intended, hours operated, date of failure and other pertinent information. Do not allow hot tubes to chill quickly by coming in contact with cold or moist surfaces as breakage may result. Important information on the care and operation of vacuum tubes will be found under Section VIII, VACUUM TUBE DATA.

5-3 Do not adjust zero readings of the meters with power ON. It is desirable to have a grounding rod (insulated rod with a flexible insulated wire fastened at one end of the rod and to ground) to attach to circuits or parts before touching them with the hands. ALWAYS GROUND INTERNAL APPARATUS BEFORE TOUCHING IT, EVEN THOUGH THE POWER SWITCH HAS BEEN OPENED.

5-4 *When servicing the units always discharge the filter capacitors as some may be holding dangerous charges even though the power may not be on the set. There are bleeder resistors or other circuits across the power filter capacitors, but the additional precaution of grounding the filter capacitors is essential in case the capacitors have not completely discharged. When shutting down the equipment, never reach inside any unit until the motor-generator set has stopped revolving, as dangerous potentials are generated at all speeds. All necessary precautions should be observed to prevent injury to personnel.*

5-5 The appearance of all of the units may be maintained by carefully dusting the entire exterior surface daily with a soft dry cloth. Occasionally it may be desirable to clean the back and side shields with a cloth that has been moistened with alcohol or uncolored carbon tetrachloride. When painting within the vicinity of the equipments, cover them with wrapping paper so that the exterior of the sets can be kept free from globules of paint. Do not paint over or attempt to finish exteriors of units. If proper care is given, the original exterior finish can be maintained throughout the life of equipment. Molded or composition insulation, capacitor plates and moving mechanical parts should be cleaned with a dry cloth, care being taken that no scratching or damage is performed during the cleaning process. Where DRY compressed air is available, it should be used to blow the dust from the interior of the set. In the absence of a dry compressed air source, a hand bellows should be used.

5-6 When cleaning, never pull or strain the wiring, as continued movement may cause breaks which are difficult to locate and repair. The felt strips between the wire clamps and the wire should be kept in place to prevent chaffing of the wire.

5-7 Relays should be inspected regularly for rust, noise, and condition of contacts. If the contacts have become rough, they should be smoothed with a jeweler's file or crocus cloth. If badly burned they should be replaced with spares. Rust on the magnet armature or pole faces may cause noise and chattering and should be removed carefully. Do not OIL OR GREASE RELAY BEARINGS as oil will collect dirt and introduce friction. To neglect relays or bearings may result in serious trouble which may be difficult to locate. For the care, operation and maintenance of the relays, see Figs. 50 and 54.

5-8 Keying Relay K-1 should be checked regularly to see that the contacts are clean and the keying action is satisfactory. DO NOT ADJUST CONTACTS UNLESS ABSOLUTELY NECESSARY. The contacts of the keying relay are set at the factory with an oscillograph to produce proper keying. It is imperative that they be left as set, unless adjustment is absolutely necessary to eliminate arcing or to correct faulty keying. The contacts then should be adjusted as shown on Fig. 50.

5-9 Special care should be observed in keeping all switches in good condition, keeping them clean and with good contacts. The switch bearings should be given an occasional drop of oil.

5-10 Slider guides and contacts on the rotating coils should be kept clean and free from binding. A very thin application of Vaseline may be used on the coils to prevent roughening of the copper.

5-11 All switches should be inspected regularly for rust and condition of contact. It may be occasionally necessary to slightly bend the switch contact springs on CARRIER CONTROL Switch S-403, Hook Switch S-401 and TALK-Switch S-404. All contacts may require occasional cleaning with very fine crocus cloth or a jeweler's file. If this is necessary, it should be followed by passing a piece of thin, closely woven cloth between the contacts to remove all abrasive particles. The interlock on Switch S-405 should be kept in good condition, as neglect will result in serious trouble which may be difficult to locate.

5-12 The contacts of Switch S-405 should be observed regularly to keep them in good condition. The switch bearings (not the contacts) should be given an occasional drop of oil.

5-13 If there is any evidence of salt deposits on any of the apparatus, it should be carefully washed out with fresh water and dried. The salt deposit can be minimized by systematic routine interior cleaning.

5-14 The operations of Voice Relay K-401 should be observed at some remote receiving point to see that no syllables are lost and that the carrier does not drop off during continuous talk. The sensitivity of the voice relay circuit may be increased by the VOICE RELAY SENSITIVITY Attenuator R-413 if necessary. Relay K-401 normally should give no trouble and, therefore, should not require readjustment. If, for any reason, the contacts do get out of adjustment they may be readjusted as follows: By means of normally closed stationary contacts, adjust relays to just close with 6 ma. through coil and with contact gap of .025 inch. Set contact gap to .025 inch by moving normally open contact. Lock contacts tight.

5-15 The magnetic controller of controllers require very little care except for inspection of contactors. Roughened appearance of contacts is no indication that good contact is not being obtained. If the contacts become badly pitted or blackened, they may be cleaned and smoothed with a fine file and fine sandpaper. The copper contacts should be renewed when the tips are burned away to the extent that the current carrying surfaces are materially affected. Neglect to change contact tips may cause an arc to burn the contact screw, making it difficult to remove. BE SURE THERE IS NO VOLTAGE ON THE CONTROLLER WHEN SERVICING. OPEN MAIN LINE SWITCH. Push the contactors closed by hand to see that no friction is present and to make sure of proper contact alignment.

5-16 The bearings of the hinge pin and armature shaft require no lubrication. Oil quickly collects dust, and unless parts are frequently cleaned, will interfere with the operation of the contactor. The sealing surfaces of the magnet core and armature should be kept clean to insure proper contact.

5-17 The commutators of the motor-generator units should be inspected occasionally to see that the brushes are not sparking excessively and that the commutators are not burned or grooved. The commutators must be kept clean and the brushes properly adjusted and fitted to the curvature of the commutators. No other attention is required by the commutator when it is taking on a polish and shows no signs of wear. *The commutators should never be lubricated.* If they become slightly rough they may be polished with a piece of fine sand-stone ground to fit. In any case, the final smoothing should be done with fine (No. 00) sandpaper. When using paper or stone, lift the brushes, and do not replace them until all grit is removed. CAUTION: NEVER USE EMERY CLOTH OR EMERY PAPER ON THE COMMUTATORS. NEVER ATTEMPT TO MAKE REPAIRS TO COMMUTATOR AND BRUSHES WHILE THE MACHINE IS RUNNING, AS THE VOLTAGES ARE DANGEROUS TO LIFE. TURN THE MOTOR-GENERATOR OVER BY HAND. The brushes are set in position at the factory, for best commutation. This adjustment should not be altered. New brushes should be the same make and grade as those shipped with the machine. When new brushes are installed, the pigtails should be free and flexible. Spring tension on brushes should be adjusted for 3 to 5 pounds per square inch.

5-18 The bearings of the motor-generator unit should be inspected regularly to make sure that they have proper lubrication. See paragraph 5-34.

5-19 The method of securing the motor and generators to the bedplate is by means of bolts, screwed into tapped holes in the bedplate.

5-20 All motor-generator units are dowelled as any misalignment will cause excessive ripple voltage. Special dowel pins are used which permit the pins to be removed from the holes. The units CAN BE LIFTED FROM THE BEDPLATE BY REMOVING THE BOLTS AND DOWEL PINS. The shafts are designed to permit disengaging the coupling without moving the units apart.

5-21 In order to obtain the extreme frequency stability of which the Radio Transmitter Unit is capable, the master oscillator unit should be kept in excellent condition. Inspect the unit regularly to see that the heated compartment is holding temperature correctly and the thermostat Relay K-8, K-20 functions properly. Keep the thermostat relay contacts in good condition and replace them with spares if they become badly worn. It is advisable to keep the heater compartment up to temperature continuously if possible. This prevents large variations in temperature of all parts of the frequency control circuit. All connections in the master oscillator unit should be kept tight and free from corrosion or dirt. Usually, any trouble in unstable frequency can be traced to loose or dirty connections in the master oscillator unit.

5-22 Calibration Reset Capacitor C-61 is located in the master oscillator heat compartment. Adjustment is made from the front panel of the unit by unlocking the knurled lock-nut (see Figure 1) and inserting a long slender screwdriver in the hole provided. The adjustment changes the capacity of a small variable capacitor. In this manner, small changes in dial calibration due to aging of parts or changing of master oscillator tubes may be corrected.

5-23 Microphone supply Rectox Rectifier RX-401 is adjusted to deliver from 11 to 13.5 volts across Capacitors C-401 and C-423. Due to the aging of the Rectox, it may be necessary to move taps connecting the Rectox A.C. terminals to Terminals 7 and 9 on Transformer T-408, T-410. When this is done care should be taken so as not to impress more than the maximum of 13.5 volts across Capacitor C-401 when the filament voltage is adjusted to 10 volts $\pm 2\%$. Tests for this voltage should be made with the microphone or Handset HS-401 on the hook.

5-24 PERCENT MODULATION Meter M-405 is a ratio meter. It has no torque spring and consequently its indication, when no current is flowing through it, is indefinite. Zero adjustment, therefore, is superfluous and none is provided. To determine if the instrument is indicating correctly, the following tests may be conducted. Disconnect the external leads from the terminals of the instrument. Pass 270 ma. of direct current from the positive terminal through the instrument to the negative terminal. The meter should read zero. Now, without changing the amount of direct current, pass 191 ma. of 60 cycle current through the winding connecting to the terminals marked A.C. The instrument should indicate 100% modulation. If the instrument indications are substantially different from those just cited, the instrument should be returned to the supplier for repair, following instructions given under contractual guarantee for the return of defective material.

5-25 Access to all parts of the master oscillator assembly, that may need servicing at any time, may be obtained from the left hand side of the Radio Transmitter Unit. This is accomplished by removing the left hand side shield of the Radio Transmitter Unit, the shield of the master oscillator assembly and the heat compartment cover. All parts of the master oscillator with the exception of doubler circuit coupling Capacitor C-13, M.O. plate choke grounding Capacitor C-12, doubler circuit tuning Capacitor C-14, 1st Int. Amp. grid coupling Capacitor C-15, doubler tank Coil L-3 and M.O. Plate Choke L-4 are then accessible. If necessary to correct trouble in the doubler circuit consisting of parts C-13, C-12, C-14, C-15, L-3, and L-4, the master oscillator unit should be removed from the frame as follows:

(a) Remove the left side and rear screens on the Radio Transmitter Unit frame. Remove the midsection of the left back frame angle by unbolting it from the gussets. This frame angle is 39⅜ inches long and secured by four machine screws at each end.

(b) Disconnect all connections to the unit at the main frame terminal blocks on the bottom, front and top. Do not overlook the grid connection at the right side of the unit. Mark leads for convenience in replacement.

(c) Remove the rubber buffer pads and braces across the left side and back of the unit.

(d) Secure a block of wood approximately 2″x4″ having a length of approximately 10″.

(e) Slip this block on the frame floor so as to support the master oscillator unit. Loosen the hose clamps between the fan and the unit.

(f) Mark the position of locknuts on turnbuckles, tying them with a string. Then, loosen the turnbuckles as far as they will extend. The lock-

nuts provided on the turnbuckles are set for proper suspension and position of the master oscillator unit and should not be moved.

(g) Reach underneath to the right hand corner of the unit and slip a wire loop through the end of the spring where it catches into the spring hook. Pull the spring with the wire loop and guide the spring out of the hook. The other three springs can be similarly unhooked.

(h) Disconnect all the top springs from the unit.

(i) With one man grasping the master oscillator unit at the back, and another at the front through the tube door, gently slide the unit out through the opening at the left side of the main frame. The unit can be rested on the block while changing hand holds. Be careful not to damage the fan motor.

5-26 The unit can be replaced in the main frame by reversing the process described in Par. 5-25.

5-27 The rubber used in this equipment for shock-mounting should be inspected regularly and should be replaced if it becomes badly cracked. The rubber used for the tube mountings may be replaced by removing the mounting screws from the holders. The rubber used for cushioning the master oscillator unit may be replaced by first removing the unit from the main frame, following the instructions given above.

5-28 Mercury thermostats and mercury or spiirt thermometers are delicate instruments which should be handled with extreme care to avoid breakage. In spite of such care, the column may separate while the glass is intact. In such situations, it is usually practicable to reunite the column by placing the instrument in a beaker of water at a temperature of about 40°C. Then, gradually add warmer water until the column reunites. In case of a thermostat operating at 60°C. the final temperature of the water in the beaker will rarely have to exceed 65° to 75°C. After the column is reunited the instruments should be gradually cooled and then tested for proper operation.

5-29 Where thermostats with leads are supplied for use or as replacements in equipment provided with mounting clips which do not require leads, it is preferable to cut the leads carefully rather than using a soldering iron. The reason for such care is that the leads are soldered to rings, on the thermostat, constructed of copper wire and solder which in turn connect with the platinum wires extend through the glass to make contact with the mercury.

B. Lubrication

5-30 The tuning dial bearings, the rotating coil bearings, variable capacitor bearings, and the switch bearings should be lubricated at least once in every six months with a few drops of a light penetrating oil such as a good typewriter oil.

5-31 Switch S-405 bearings should be oiled at least once every six months with light machine oil. Do not lubricate the bearings or contacts of Relays K-401 or any of the other switches.

5-32 The switch contacts and blades should be lubricated with a thin coat of Vaseline. DO NOT LUBRICATE THE MASTER OSCILLATOR RANGE SWITCH contacts S-1.

5-33 Blower Motor B-11, B-1 in the master oscillator compartment is fitted with ball bearings and should be greased once or twice a year, depending upon the service, with Navy Grade 14L3 medium grease. The bearings should never be more than two-thirds full.

5-34 The motor-generator is equipped with ball bearings, and is shipped with sufficient grease in the bearings to provide for six months or more of service. Do not screw down the grease cups unless the bearings actually require lubrication. Excessive grease is detrimental to ball bearings. A hot bearing is not an indication of insufficient lubrication, but rather may be caused by an excess of grease. Clicking bearings is an indication of insufficient lubrication or possibly a defective bearing. At intervals of about six months or more of service (for normal operation) the bearings should be greased. Use a high grade sodium base, clean, ball bearing grease, similar to that supplied with the set, or Navy Grade 14L3 Soft. When lubricating, remove bearing drain plug and with set running, force in clean grease via the grease cups until clean grease appears at the outlets. Allow set to operate for about fifteen minutes and then replace drain plugs. At intervals of about two years, the bearing caps should be removed and the bearings washed out and repacked with clean grease. KEEP GREASE AND BEARINGS CLEAN, DIRT DESTROYS BALL BEARINGS.

C. Maintenance Schedule

5-35 *A maintenance schedule, based on the following hints, and strictly adhered to, will do much to keep the Radio Transmitter Unit in good operating condition with a minimum of shut-down time.*

(1) *Daily:*

a. Check all control circuits for proper operation.

b. Check and record all meter and thermometer readings in log book.

c. Check tuning of equipment on at least three frequencies.

d. Dust exterior of equipment.

(2) *Weekly:*

a. Carefully clean entire equipment inside and out.

b. Inspect and tighten all electrical connections.

c. Clean and inspect all contactor and relay contacts.

d. Clean all switch blade contacts.

(3) *Monthly:*

a. Check all tubes. This can be done by checking the daily meter readings in the log of the transmitter. Any gradual change in the tube will be indiacted by a gradual change in plate current, all other factors being constant. The tubes in need of replacement can thereby be attended to without series loss of power.

(4) *Yearly:*

a. Clean and repack the bearings of the Blower Motor.

D. Troubles and Causes

5-36 OPERATING START-STOP SWITCH S-8, S-17 ON THE RADIO TRANSMITTER UNIT DOES NOT OPERATE THE STARTING SOLENOID.

a. Some access door on either transmitter or modulator open.

b. REMOTE-LOCAL Switch S-7 in wrong position.

c. Overload relays not reset.

d. Power supply switch open.

e. No line voltage, or line voltage too low.

f. EMERGENCY SWITCH S-12 open.

g. Fuse F-2 open.

5-37 OPERATING START-STOP SWITCH S-8, S-17 IN THE TRANSMITTER UNIT DOES NOT START MOTOR-GENERATOR.

a. Main line switch open.

b. Some access door on transmitter unit or modulator unit open.

c. Magnetic controller or transmitter overload relays not reset.

d. No line voltage, or line voltage too low.

5-38 MOTOR GENERATOR UNIT OPERATES SATISFACTORY BUT LOW PLATE VOLTAGE AT RADIO TRANSMITTER UNIT OR MODULATOR UNIT.

a. Overload relays not reset.

b. TUNE-OPERATE Switch S-9 on transmitter in TUNING STEP 1.

c. Open connection to motor-generator unit.

d. Fuses open in motor-generator unit.

e. Field Contactor K-9 (D.C.), or K-19 (A.C.) on transmitter not closed.

5-39 OPERATING TEST KEY CAUSES NO INDICATION ON MASTER OSCILLATOR METERS.

a. Keying Relay K-1 inoperative.

b. Dirty keying contacts.

c. No plate voltage on master oscillator.

d. Open grid leak.

e. Open screen or plate series resistor.

f. Screen by-pass or plate by-pass capacitor broken down.

g. Open interlock circuit or range switch.

5-40 TUNING DOUBLER TUNING CIRCUIT CAUSES EXTREME REACTION ON MASTER OSCILLATOR SCREEN CURRENT AND FREQUENCY.

a. Inaccurate setting Dial "C". Doubler circuit tuned to fundamental instead of harmonic frequency.

5-41 FIRST INTERMEDIATE AMPLIFIER DOES NOT RESONATE.

a. Doubler tuning circuit improperly tuned.

b. Range Switch S-2 in wrong position.

5-42 NO FILAMENT VOLTAGE.

a. Transformer T-408, T-410 connection open.

b. Starting Contactor K-4 (D.C.), or K-14 (A.C.), on transmitter not closed.

c. Fuse F-401 or F-402 open.

5-43 MODULATOR OR AMPLIFIER TUBES OVERHEAT OR DRAW EXCESSIVE PLATE CURRENT.

a. Bias too low. (This applies only to amplifier tubes.)

b. Audio input too high.

c. Amplifier grid circuits grounded.

d. Modulation Transformer T-405 or Reactor L-404 short circuited.

e. Defective tubes.

5-44 PERCENT MODULATION METER M-405 READS OVER 100%.

a. Audio input too high.

b. Antenna radiation from transmitter too low due to non-resonance.

c. Transmitter power amplifier plate circuit open.

d. Percent Modulation Meter M-405 indicating incorrectly.

5-45 OPERATION APPARENTLY NORMAL BUT RECEPTION REPORTS INDICATE AUDIO DISTORTION PARTICULARLY ON HIGH PERCENTAGE MODULATION.

a. Off-resonant tuning of transmitter power amplifier.

b. Insufficient excitation to transmitter power amplifier.

c. Overmodulation: Note that voice modulation giving 100% modulation has an average percentage modulation usually below 40%.

5-46 OPERATION APPARENTLY NORMAL BUT RECEPTION REPORTS INDICATE LOSS OF SYLLABLES OR LOSS OF CARRIER DURING CONTINUOUS TALK.

a. VOICE RELAY SENSITIVITY Attenuator R-413 set too low.

b. Audio input too low.

c. SPEECH GAIN Attenuator R-401 set too low.

d. Defective Tube VT-408.

e. Improper contact adjustment of voice Relay K-401.

5-47 VOICE RELAY CHATTERS

a. Voice relay sensitivity Control R-413 set too high.

b. Poor grounding of cable leads.

c. Improper contact adjustment.

5-48 SPARK GAPS BREAK DOWN ON LESS THAN 100% MODULATION.

a. Gap adjustment wrong. (gap should be approximately .035 inch on Transformer T-405 and .065 inch on Reactor L-404)

b. Humidity extremely high.

c. Percent Modulation Meter M-405 indicating incorrectly.

d. Rough gap surfaces.

5-49 NOISE LEVEL HIGH WHEN USING REMOTE SPEECH INPUT EQUIPMENT BUT NORMAL WITH LOCAL TEST MICROPHONE HS-401.

a. High room noise near remote microphone.

b. Grounded audio line.

c. Open audio line.

d. Defective microphone.

5-50 AUDIO DISTORTION WHEN USING LOCAL HANDSET HS-401 BUT NORMAL WITH REMOTE SPEECH INPUT EQUIPMENT.

a. Voltage across microphone filter Capacitor C-423 low due to microphone supply Rectox RX-401 aging.

b. Defective Handset HS-401.

5-51 CIRCUITS OPERATE SATISFACTORILY, BUT NO ANTENNA CURRENT OR POWER AMPLIFIER LOADING.

a. Antenna circuits out of resonance.

b. Antenna shorted or open.

c. Antenna ammeter open.

d. Auxiliary screen grid connection off of Type 861 amplifier tube.

5-52 SET OPERATES NORMALLY WHEN KEY IS DOWN BUT AMPLIFIER TUBES DO NOT BLOCK WHEN KEY IS UP.

a. Insufficient bias on tubes. Check brushes on bias generator.

b. Open connection to bias generator, check fuse.

c. Defective amplifier tube.

d. Ground on keying circuit causes master oscillator to run continuously.

5-53 AMPLIFIER TUBE HEATS EXCESSIVELY WHEN KEY IS CLOSED AND ANTENNA CIRCUIT IS IN TUNE.

a. Antenna too tightly coupled.

b. Excessive plate voltage.

c. Defective amplifier tube.

5-54 FREQUENCY HOPS OR JUMPS.

a. Defective master oscillator tube. Be sure anchored filament type is used in the master oscillator.

b. Variable grounds around the master oscillator circuit caused by loose box cover, loose screens, etc.

c. Mounting screws of master oscillator tube socket making variable contact with tube base. Tube base SHOULD NOT be grounded.

d. Defective grid leak.

e. Loose grid connection.

f. Fluttering master oscillator plate supply voltage, caused by dirty commutator or sticking brush.

5-55 MAGNETIC CONTROLLER OPERATES, BUT OVERLOAD RELAY TRIPS TOO QUICKLY.

a. Overload relay set too low.

b. On D.C. equipments, not enough current in holding coil of accelerating Contactors K-842, K-852 and K-843, K-853.

E. Circuit Checking, General

5-56 In case trouble appears to be in the interlock circuits of the doors or switches, terminals are provided on the transmitter terminal board which permit circuit checking to definitely locate such trouble. Switch Interlocks S-1C, S-9B and S-2A which are normally connected in the keying circuit are connected between terminals 19 and 20 of the terminal board. This wiring provides the following possible circuit checking.

1. Test between Terminals 19 and 20. Check should show complete short circuit (zero ohms) if Interlock Switches S-1C, S-9B and S-2A are operating properly. An open circuit would indicate one or more of the above interlocks is open.

2. Test between Terminal 20 and 6 with LOCAL-REMOTE Switch S-7 in REMOTE position. Check should indicate approximately 625 to 850 ohms (the value of K-1 and K-2 coils in parallel). If the check indicates a higher resistance circuit, K-1 or K-2 coil circuit is defective.

3. Test between Terminals 12 and 13. Check should indicate a short circuit. If check indicates an open circuit, the trouble is due to defective door interlocks in the Modulator.

4. Test between Terminals 15 and 16. Check should indicate a short circuit. If check indicates an open circuit, the trouble is due to a defective switch interlock on S-405 in the Modulator.

5. Test between S-18F and Terminal 13. Check should indicate a short circuit. If check does not indicate a short circuit, overload relay contact K-5B is open.

6. Test between Terminal 12 and Terminal 40. Door Interlocks S-14, S-15 and S-16 and the low voltage overload Relay K-7 contacts are in series between these terminals. The check between these terminals should show a complete short circuit (zero ohms) if all interlocks are functioning properly. An open circuit indicates that one or more of the door interlocks or the Overload Relay K-7 contacts are not completing the circuit.

5-57 In case of an emergency, temporary operation can be obtained if interlocks are out of order by shorting between Terminals 19 and 20 or 12 and 40.

TABLE I
LIST OF MAJOR UNITS FOR
MODEL TBM-11 RADIO TRANSMITTING EQUIPMENT

QUANTITY 115 V.D.C.	QUANTITY 230 V.D.C.	QUANTITY 440/3/60	SYMBOL GROUP	NAVY TYPE DESIGNATION	NAME OF MAJOR UNIT	ASSEMBLY DRAWING NUMBER
1			1 TO 99	CAY-52217	TRANSMITTER UNIT	7502613 G1
	1		1 TO 99	CAY-52218	TRANSMITTER UNIT	7502613 G2
		1	1 TO 99	CAY-52171	TRANSMITTER UNIT	7502613 G3
		X	201 TO 210	CAY-21682	MOTOR	7502615 L6, SH.2
X	X	X	211 TO 220	CAY-21679	L.V. & BIAS GENERATOR	7502615 G1,2,3
X	X	X	221 TO 240	CAY-21680	HIGH VOLTAGE GENERATOR	7502615 G1,2,3
	X		241 TO 260	CAY-21681	MOTOR	7502615 L19, SH.1
X			271 TO 290	CAY-21678	MOTOR	7502615 L5, SH.1
1			201 TO 290	CAY-21675	MOTOR GENERATOR COMPLETE	7502615 G1
	1		201 TO 290	CAY-21676	MOTOR GENERATOR COMPLETE	7502615 G2
		1	201 TO 290	CAY-21677	MOTOR GENERATOR COMPLETE	7502615 G3
1	1	1	401 TO 499	CAY-50065-A	MODULATOR	7502614 G1
1			841 TO 850	CAY-211231	MAGNETIC CONTROLLER	7502882 G1
	1		851 TO 860	CAY-211232	MAGNETIC CONTROLLER	7502882 G2
		1	861 TO 870	CAY-211233	MAGNETIC CONTROLLER	7502882 G4

NOTE: BOX 1 - CONTAINS TRANSMITTER SPARE PARTS.
BOX 2 - CONTAINS MOTOR GENERATOR & MAGNETIC CONTROLLER SPARE PARTS.
BOX 3 - CONTAINS H.V. GENERATOR ARMATURE.
BOX 4 - CONTAINS L.V. GENERATOR ARMATURE.
BOX 5 - CONTAINS MODULATOR SPARE PARTS.
BOX 6 - CONTAINS MOTOR ARMATURE SPARES.

TABLE II

PARTS AND SPARE PARTS LIST BY SYMBOL DESIGNATION FOR MODEL TBM-11 RADIO TRANSMITTING EQUIPMENT

SUPPLY 115 V.D.C.	SUPPLY 230 V.D.C.	SUPPLY 440/3/60	SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY SPEC. OR DRAWING NUMBER	MFR.	MFR. DESIG.	SPECIAL TOL RATING OR MODIFICATION	CONTRACTOR'S DRAWING AND PART NUMBER	SPARE PARTS BOX NUMBER	SPARE PARTS QUANTITY 115 V.D.C.	SPARE PARTS QUANTITY 230 V.D.C.	SPARE PARTS QUANTITY 440/3/60	ALL SYMBOL DESIGNATIONS INVOLVED
					BLOWER MOTORS (CLASS 21)											
X	X		B-1	BLOWER MOTOR	115 V.D.C., 3000 R.P.M., 1/75 H.P.	-21131B		1	S#952446		T-7607280 P1	1	1	1	0	B-1
X	X		B-1A	BLOWER MOTOR BEARINGS	FOR B-1 MOTOR			1			T-7607280 P2	1	4	4	0	B-1A
X	X		B-1B	BLOWER MOTOR BRUSHES	FOR B-1 MOTOR			1			T-7607280 P3	1	40	40	0	B-1B
		X	B-11	BLOWER MOTOR	110 V., 60 CYCLES, 3000 R.P.M., 1/75 H.P.	-21130B		1	S#954111		T-7607280 P4	1	0	0	1	B-11
		X	B-11A	BLOWER MOTOR BEARINGS	FOR B-11 MOTOR			1			T-7607280 P5	1	0	0	4	B-11A
					CAPACITORS (CLASS 48)											
X	X	X	C-1	M.O. TANK CAPACITOR	0.00075 MFD. ±2%, 5000 VOLTS EFF. TEST #(5, 3.5, 2, 1), MICA, CONSTANT CAPACITY AT 60°C	-48477-D2	RE48AA131C	2			T-7607280 P15	1	1	1	1	C-1,C-3
X	X	X	C-2	M.O. TANK CAPACITOR	0.003 MFD. ±2%, 3000 VOLTS TEST EFF. #(8, 6, 4, 2), MICA. CONSTANT CAPACITY AT 60°C	-48365-D2	RE48AA131C	2			T-7607280 P16	1	1	1	1	C-2
X	X	X	C-3	M.O. TANK CAPACITOR	SAME AS C-1	-48477-D2						1				
X	X	X	C-4	M.O. FIL. BY-PASS CAPACITOR	0.01 MFD. ±10%, 1000 V. TEST, 600 V. WORKING, MICA	-48027-10	RE48AA112N	3			T-7607280 P18	1	5	5	5	C-4,C-5,C-8,C-9,C-17 C-18,C-26,C-27,C-35, C-36
X	X	X	C-5	M.O. FIL. BY-PASS CAPACITOR	SAME AS C-4	-48027-10						1				
X	X	X	C-6	M.O. SCREEN BY-PASS	0.1 MFD. ±5%, 1000 V. TEST EFF., #(18, 15, 12, 7), MICA	-48478-B5	RE48AA131C	3			T-7607280 P20	1	1	1	1	C-6
X	X	X	C-7	GRID BY-PASS CAPACITOR	0.015 MFD. ±2%, 1500 V. TEST EFF., #(12, 10, 7, 4), MICA. CONSTANT CAPACITY AT 60°C	-48204-D2	RE48AA131C	2			T-7607280 P21	1	1	1	1	C-7
X	X	X	C-8	M.O. FIL. BY-PASS CAPACITOR	SAME AS C-4	-48027-10						1				
X	X	X	C-9	M.O. FIL. BY-PASS CAPACITOR	SAME AS C-4	-48027-10						1				
X	X	X	C-10	M.O. SCREEN CURRENT METER BY-PASS CAPACITOR	0.006 MFD. ±10%, 1000 V.D.C., TEST 600 V.D.C. WORKING, MICA	-48410-10	RE48AA112N	3			T-7607280 P24		0	0	0	C-10,C-11,C-23,C-24, C-31,C-32,C-43,C-46, C-50,C-51,C-52
				CAPACITOR - SPARE FOR C10	SAME AS C-10 EXCEPT OMIT "E" BRACKET	-48410-10					T-7607280 P14	1	6	6	6	
X	X	X	C-11	M.O. PLATE CURRENT METER BY-PASS CAPACITOR	SAME AS C-10	-48410-10										
X	X	X	C-12	M.O. PLATE BY-PASS CAPACITOR	0.002 MFD., ±10%, 5000 V.D.C. TEST, 2500 V.D.C. WORKING, MICA	-48037-10	RE48AA112N	3			T-7607280 P26	1	3	3	3	C-12,C-16,C-25,C-33, C-34,C-37

CURRENT RATINGS AT 3000, 1000, 300, 100 KC.

TABLE II (CONTINUED)

PARTS AND SPARE PARTS LIST BY SYMBOL DESIGNATION FOR MODEL TBM-11 RADIO TRANSMITTING EQUIPMENT

SUPPLY 115 V.D.C.	SUPPLY 230 V.D.C.	SUPPLY 440/3/60	SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY SPEC. OR DRAWING NUMBER	MFR.	MFR. DESIG.	SPECIAL TOL RATING OR MODIFICATION	CONTRACTOR'S DRAWING AND PART NUMBER	SPARE PARTS BOX NUMBER	SPARE PARTS QUANTITY 115 V.D.C.	SPARE PARTS QUANTITY 230 V.D.C.	SPARE PARTS QUANTITY 440/3/60	SPARE PARTS ALL SYMBOL DESIGNATIONS INVOLVED
					CAPACITORS (CLASS 48) CONTINUED											
X	X	X	C-13	DOUBLER CIRCUIT COUPLING CAPACITOR	.000031 MFD. MAX., 0.000006 MFD. MIN. (0.0715" SPACING) VARIABLE, AIR			4	MCD-35MX		T-7607280 P27		0	0	0	C-13
X	X	X	C-14	DOUBLER CIRCUIT TUNING CAPACITOR	0.00075 MFD. MAX., 0.000024 MFD. MIN. VARIABLE, AIR			5	X-750-ES	MYCALEX INS. STAIN. ST. SHAFT. CAP DECREASE WITH CLOCKWISE ROTATION	T-7605863 P4		0	0	0	C-14
X	X	X	C-15	1ST INT. GRID COUPLING CAPACITOR	0.00007 MFD. ±10%, 5000 V.D.C. TEST, 2500 V.D.C. WORKING, MICA	-48039-10	RE48AA112N	3			T-7607280 P29	1	1	1	1	C-15
X	X	X	C-16	1ST INT. GRID CHOKE BY-PASS CAPACITOR	SAME AS C-12	-48037-10						1				
X	X	X	C-17	1ST INT. FILAMENT BY-PASS CAPACITOR	SAME AS C-4	-48027-10						1				
X	X	X	C-18	1ST INT. FILAMENT BY-PASS CAPACITOR	SAME AS C-4	-48027-10						1				
X	X	X	C-19	1ST INT. SCREEN BY-PASS CAPACITOR	0.01 MFD. ±10%, 2500 V.D.C. TEST, 1200 V.D.C. WORKING, MICA	-48035-10	RE48AA112N	3			T-7607280 P33	1	1	1	1	C-19,C-28
X	X	X	C-20	1ST INT. PLATE BY-PASS CAPACITOR	0.01 MFD. ±10%, 5000 V.D.C. TEST, 2500 V.D.C. WORKING, MICA	-48382-10	RE48AA112N	3			T-7607280 P34	1	1	1	1	C-20,C-30
X	X	X	C-21	1ST INT. AMP. TUNING CAPACITOR	0.00045 MFD. MAX., 0.000045 MFD. MIN. (0.08" SPACING) VARIABLE, AIR			4	TC-450-BW		T-7607256 P3		0	0	0	C-21
X	X	X	C-22	2ND INT. AMP. GRID COUPLING CAPACITOR	0.00025 MFD. ±10%, 5000 V.D.C. TEST, 2500 V.D.C. WORKING, MICA	-48330-10	RE48AA112N	3			T-7607280 P36	1	1	1	1	C-22
X	X	X	C-23	1ST INT. AMP. PLATE CURRENT METER BY-PASS CAPACITOR	SAME AS C-10	-48410-10						1				
X	X	X	C-24	2ND I.A. GRID CURRENT AMMETER BY-PASS CAPACITOR	SAME AS C-10	-48410-10						1				
X	X	X	C-25	2ND INT. AMP. GRID CHOKE BY-PASS CAPACITOR	SAME AS C-12	-48037-10						1				
X	X	X	C-26	2ND INT. AMP. FILAMENT BY-PASS CAPACITOR	SAME AS C-4	-48027-10						1				
X	X	X	C-27	2ND INT. AMP. FILAMENT BY-PASS CAPACITOR	SAME AS C-4	-48027-10						1				
X	X	X	C-28	2ND INT. SCREEN BY-PASS CAPACITOR	SAME AS C-19	-48035-10						1				

TABLE II (CONTINUED)

PARTS AND SPARE PARTS LIST BY SYMBOL DESIGNATION FOR MODEL TBM-11 RADIO TRANSMITTING EQUIPMENT

SUPPLY 115 V.D.C.	SUPPLY 230 V.D.C.	SUPPLY 440/3/60	SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY SPEC. OR DRAWING NUMBER	MFR.	MFR. DESIG.	SPECIAL TOL RATING OR MODIFICATION	CONTRACTOR'S DRAWING AND PART NUMBER	SPARE PARTS BOX NUMBER	SPARE PARTS QUANTITY 115 V.D.C.	SPARE PARTS QUANTITY 230 V.D.C.	SPARE PARTS QUANTITY 440/3/60	ALL SYMBOL DESIGNATIONS INVOLVED
					CAPACITORS (CLASS 48) CONTINUED											
X	X	X	C-29	2ND INT. AMP. TUNING CAPACITOR	0.00016 MFD., DOUBLE SECTION, EACH SECTION 0.0032 MFD., (0.08" SPACING ROUNDED PLATES 0.04" THICK) VARIABLE AIR			4	TCD-320-BW	STAINLESS STEEL SHAFT	T-7607256 P2		0	0	0	C-29
X	X	X	C-30	2ND INT. AMP. PLATE BY-PASS CAPACITOR	SAME AS C-20	-48382-10						1				
X	X	X	C-31	2ND INT. AMP. PLATE CURRENT AMMETER BY-PASS CAPACITOR	SAME AS C-10	-48410-10						1				
X	X	X	C-32	P.A. GRID CURRENT METER BY-PASS CAPACITOR	SAME AS C-10	-48410-10						1				
X	X	X	C-33	P.A. GRID BLOCKING CAPACITOR	SAME AS C-12	-48037-10						1				
X	X	X	C-34	P.A. GRID CHOKE BY-PASS CAPACITOR	SAME AS C-12	-48037-10						1				
X	X	X	C-35	P.A. FILAMENT BY-PASS CAPACITOR	SAME AS C-4	-48027-10						1				
X	X	X	C-36	P.A. FILAMENT BY-PASS CAPACITOR	SAME AS C-4	-48027-10						1				
X	X	X	C-37	P.A. SCREEN BY-PASS CAPACITOR	SAME AS C-12	-48037-10						1				
			C-38	NOT USED												
X	X	X	C-39	P.A. TUNING CAPACITOR	0.00016 MFD. DOUBLE SECTION, EACH SECTION 0.00032 MFD., (0.10" SPACING ROUNDED PLATES 0.04" THICK) VARIABLE AIR			4			T-7607256 P1		0	0	0	C-39
X	X	X	C-40	P.A. PLATE BY-PASS CAPACITOR	0.0005 MFD. ±5%, 7500 TEST VOLTS EFF #(4, 3, 1.5, .5), MICA	-481215-5	RE48AA131C	2			T-7607280 P54	1	1	1	1	C-40
X	X	X	C-41	ANTENNA COUPLING CAPACITOR	0.00006 MFD., VARIABLE, AIR			1			T-7604452 G7		0	0	0	C-41
X	X	X	C-42	ANTENNA TUNING CAPACITOR	0.0003 MFD. MAX., 0.000052 MFD. MIN., (0.23" SPACING), VARIABLE, AIR			5	TK-300-US	STAINLESS STEEL SHAFT	T-7607403 P1		0	0	0	C-42
X	X	X	C-43	P.A. PLATE CURRENT METER BY-PASS CAPACITOR	SAME AS C-10	-48410-10						1				
X	X	X	C-44	ANTENNA H.V. BLOCKING CAPACITOR	0.004 MFD. ±5%, 3000 TEST VOLTS EFF #(11, 8.5, 5.5, 2.5), MICA	-48218-5	RE48AA131C	6 2			T-7607280 P58	1	1	1	1	C-44
X	X	X	C-45	KEYING RELAY ARC SUPPRESSOR CAPACITOR	1.0 MFD. ±10%, 600 V.D.C. WORKING, PAPER	-48686-10	RE13A488G	6 2			T-7607280 P59	1	2	2	1	C-45, C-63, C-64

#CURRENT RATINGS AT 3000, 1000, 300, 100 KC.

TABLE II (CONTINUED)

PARTS AND SPARE PARTS LIST BY SYMBOL DESIGNATION FOR MODEL TBM-11 RADIO TRANSMITTING EQUIPMENT

SUPPLY 115 V.D.C.	SUPPLY 230 V.D.C.	SUPPLY 440/3/60	SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY SPEC. OR DRAWING NUMBER	MFR.	MFR. DESIG.	SPECIAL TOL RATING OR MODIFICATION	CONTRACTOR'S DRAWING AND PART NUMBER	SPARE PARTS BOX NUMBER	SPARE PARTS QUANTITY 115 V.D.C.	SPARE PARTS QUANTITY 230 V.D.C.	SPARE PARTS QUANTITY 440/3/60	ALL SYMBOL DESIGNATIONS INVOLVED
					CAPACITORS (CLASS 48) CONTINUED											
X	X	X	C-46	FILAMENT VOLTMETER BY-PASS CAPACITOR	SAME AS C-10	-48410-10						1				
X	X	X	C-47	M.O. PLATE VOLTAGE FILTER CAPACITOR	4 MFD. ±10%, 1000 V.D.C. WORKING, PAPER	-48683-10	RE13A488C	1	TYPE FL		T-7607280 P61	1	1	1	1	C-47
X	X	X	C-48	BIAS FILTER CAPACITOR	6.0 MFD. ±10%, 600 V.D.C. WORKING, PAPER	-48685-10	RE13A488C	1	TYPE FL		T-7607280 P62	1	1	1	1	C-48
X	X	X	C-49	PLATE VOLTMETER MULTIPLIER BY-PASS CAPACITOR	0.001 MFD. ±5%, 7500 TEST VOLTS EFF. MICA	-481216-5	RE48AA131C	2			T-7607280 P63	1	1	1	1	C-49
X	X	X	C-50	P.A. TUBE HOUR METER BY-PASS CAPACITOR	SAME AS C-10	-48410-10						1				
X	X	X	C-51	BIAS VOLTMETER BY-PASS CAPACITOR	SAME AS C-10	-48410-10						1				
X	X	X	C-52	PLATE VOLTMETER BY-PASS CAPACITOR	SAME AS C-10	-48410-10						1				
X	X	X	C-53	2ND INT. AMP. TANK CAPACITOR	0.00015 MFD. ±5%, 5000 TEST VOLTS EFF., 7.5 AMPS. AT 4500 KC, 6 AMPS. AT 3000 KC, 3 AMPS. AT 1000 KC, 1.5 AMPS. AT 300 KC, 0.35 AMP. AT 100 KC., MICA	-48535-5	RE48AA132A	6 2			T-7607280 P67	1	1	1	1	C-53
X	X	X	C-54	P.A. TANK CAPACITOR	0.00015 MFD. ±5%, 20,000 TEST VOLTS EFF #(5, 3.8, 2.5, 1.3), MICA	-48534-5	RE48AA122E	6			T-7607280 P68	1	1	1	1	C-54
X	X	X	C-55	P.A. GRID COUPLING CAPACITOR	0.000075 MFD. MAX., 0.000011 MFD. MIN (0.07" SPACING) VARIABLE, AIR			5	NP-75-DS	ST.STEEL SHAFT WITH MYCALEX INS. SCREW DRIVER SLOT	T-7607403 P4		0	0	0	C-55
X	X	X	C-56	M.O. TANK CAPACITOR	0.000375 MFD. ±2%, 5000 TEST VOLTS EFF. #(4, 2.5, 1.0, 0.5), MICA CONSTANT CAPACITY	-48481-D2	RE48AA131C	2			T-7607280 P70	1	1	1	1	C-56
X	X	X	C-57	P.A. GRID CAPACITOR	0.000025 MFD. ±5%, 10,000 TEST VOLTS EFF. #(3, 1.0, 0.3, 0.5), MICA	-48423-5	RE13A389K	2			T-7607280 P71	1	1	1	1	C-57
X	X	X	C-58	H.V. FILTER CAPACITOR	4.0 MFD. ±10%, 3000 V.D.C. WORKING PAPER	-48685-10	RE13A488C	1	TYPE FL		T-7607280 P72	1	1	1	1	C-58,C-65
		X	C-59	BLOWER MOTOR STARTING CAPACITOR	2.0 MFD., 600 V.D.C. WORKING, PAPER	-48687-10	RE13A488C	7	TJ-6020		T-7607281 P73	1	0	0	1	C-59
X	X	X	C-60	THERMOSTAT RELAY SPARK SUPPRESSOR CAPACITOR	0.5 MFD. ±10%, 400 V.D.C. WORKING, PAPER	-48205-A10	RE13A488C	6 7	DYR-6050		T-7607281 P74	1	1	1	1	C-60
X	X	X	C-61	CALIBRATION RESET CAPACITOR	0.000002 MFD., VARIABLE, AIR			1			M-7405440 G-1	0	0	0	0	C-61

CURRENT RATINGS AT 3000, 1000, 300, 100 KC.

TABLE II (CONTINUED)

PARTS AND SPARE PARTS LIST BY SYMBOL DESIGNATION FOR MODEL TBM-11 RADIO TRANSMITTING EQUIPMENT

SUPPLY 115 V.D.C.	SUPPLY 230 V.D.C.	SUPPLY 440/3/60	SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY SPEC. OR DRAWING NUMBER	MFR.	MFR. DESIG.	SPECIAL TOL RATING OR MODIFICATION	CONTRACTOR'S DRAWING AND PART NUMBER	SPARE PARTS BOX NUMBER	SPARE PARTS QUANTITY 115 V.D.C.	SPARE PARTS QUANTITY 230 V.D.C.	SPARE PARTS QUANTITY 440/3/60	ALL SYMBOL DESIGNATIONS INVOLVED
				CAPACITORS (CLASS 48) CONTINUED												
X	X	X	C-62	COMPENSATING CAPACITOR	0.00001 MFD. VARIABLE, AIR			1			K-7810264 G-3		0	0	0	C-62
X	X		C-63	BLOWER MOTOR BY-PASS CAPACITOR	SAME AS C-45	-48686-10						1				
X	X		C-64	BLOWER MOTOR BY-PASS CAPACITOR	SAME AS C-45	-48686-10						1				
X	X	X	C-65	H.V. FILTER CAPACITOR	SAME AS C-58	-48685-10						1				
X	X	X	C-66	H.V. R.F. BY-PASS CAPACITOR	0.0001 MFD. ±5%, 7500 V.D.C. TEST VOLTS EFF. #(1.3,.5, .3, .1) MICA	-481214-5	RE48AA131C	2			T-7607281 P80	1	1	1	1	C-66
X	X	X	C-67	P.A. SCREEN BY-PASS CAPACITOR	0.0001 MFD. ±10%, 5000 V.D.C. TEST, 2500 V.D.C. WORKING	-48001-10	RE48AA112N	3			T-7607281 P81	1	1	1	1	C-67
X	X	X	C-68	FREQUENCY METER R.F. COUPLING CAPACITOR	SPECIAL ADJUSTMENT BAND ON CERAMIC INSULATORS			1			M-7407390 G1		0	0	0	C-68
X	X	X	C-401	MICROPHONE FILTER CAPACITOR	500 MFD. +100%,-10%, 15 VOLTS, ELECTROLYTIC	-48340	RE13A549A	2			T-7606286 P1	5	2	2	2	C-401,C-417,C-418, C-423
X	X	X	C-402	BY-PASS CAPACITOR	0.1 MFD., ±10%, 600 V.D.C. WORKING, PAPER	-48197-A10	RE13A488C	2			T-7606286 P2	5	1	1	1	C-402,C-424
X	X	X	C-403	BY-PASS CAPACITOR	1.0 MFD. ±10%, 400 V.D.C. TEST, 200 V.D.C. WORKING, PAPER	-482063-10	RE13A488C	2			T-7605848 P27	5	2	2	2	C-403,C-406,C-415 C-422
X	X	X	C-404	METER BY-PASS CAPACITOR	SAME AS C-10	-48410-10						5	3	3	3	C-404,C-407,C-409, C-410,C-413,C-416
X	X	X	C-405	TONE OSCILLATOR CAPACITOR	0.025 MFD. ±10%, 1000 V. TEST, 400 VOLTS WORKING	-48591-10	RE48AA112N	2			T-7606286 P5	5	1	1	1	C-405,C-412
X	X	X	C-406	BY-PASS CAPACITOR	SAME AS C-403	-482063						5				
X	X	X	C-407	METER BY-PASS CAPACITOR	SAME AS C-10	-48410-10						5				
X	X	X	C-408	MODULATOR COUPLING CAPACITOR	2 MFD. ±10%, 3000 V.D.C. WORKING, PAPER	-48526	RE13A488C	1	TYPE FL		T-7606286 P8	5	1	1	1	C-408,C-411
X	X	X	C-409	METER BY-PASS CAPACITOR	SAME AS C-10	-48410-10						5				
X	X	X	C-410	METER BY-PASS CAPACITOR	SAME AS C-10	-48410-10						5				
X	X	X	C-411	MODULATOR PLATE BY-PASS CAPACITOR	SAME AS C-408	-48526						5				
X	X	X	C-412	MODULATOR METER CAPACITOR	SAME AS C-405	-48591-10						5				
X	X	X	C-413	METER BY-PASS CAPACITOR	SAME AS C-10 EXCEPT MTG. BRACKETS OMITTED	-48410-10					T-7606233 P29	5				

TABLE II (CONTINUED)

PARTS AND SPARE PARTS LIST BY SYMBOL DESIGNATION FOR MODEL TBM-11 RADIO TRANSMITTING EQUIPMENT

SUPPLY 115 V.D.C.	SUPPLY 230 V.D.C.	SUPPLY 440/3/60	SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY SPEC. OR DRAWING NUMBER	MFR.	MFR. DESIG.	SPECIAL TOL RATING OR MODIFICATION	CONTRACTOR'S DRAWING AND PART NUMBER	SPARE PARTS BOX NUMBER	SPARE PARTS QUANTITY 115 V.D.C.	SPARE PARTS QUANTITY 230 V.D.C.	SPARE PARTS QUANTITY 440/3/60	ALL SYMBOL DESIGNATIONS INVOLVED
					CAPACITORS (CLASS 48) CONTINUED											
X	X	X	C-414	VOICE RELAY GRID CAPACITOR	.02 MFD. ±10%, 1000 V.D.C. TEST, 600 V.D.C. WORKING	-48428-10	RE48AA112N	2			T-7606286 P14	5	1	1	1	C-414
X	X	X	C-415	BY-PASS CAPACITOR	SAME AS C-403	-482063-10						5				
X	X	X	C-416	METER BY-PASS CAPACITOR	SAME AS C-10	-48410-10						5				
X	X	X	C-417	FILTER CAPACITOR	SAME AS C-401	-48340						5				
X	X	X	C-418	FILTER CAPACITOR	SAME AS C-401	-48340						5				
X	X	X	C-419	BY-PASS CAPACITOR	8 MFD. ±10%, 1200 V.D.C. TEST, 600 V D.C. WORKING, PAPER	-481171-10	RE13A488C	2			T-7605848 P24	5	1	1	1	C-419
X	X	X	C-420	SCREEN COUPLING CAPACITOR	2 MFD. ±10%, 600 V.D.C. WORKING, PAPER	-48687-10	RE13A488C	1	TYPE FL S#1173042		T-7605848 P25	5	1	1	1	C-420
X	X	X	C-421	BY-PASS CAPACITOR	SAME AS C-420	-48687-10						5				
X	X	X	C-422	BY-PASS CAPACITOR	SAME AS C-403	-482063-10						5				
X	X	X	C-423	FILTER CAPACITOR	SAME AS C-401	-48340						5				
X	X	X	C-424	BY-PASS CAPACITOR	SAME AS C-402	-48197-A10						5				
X	X	X	C-425	GAP SHUNT CAPACITOR	0.0005 MFD. ±10%, 5000 V.D.C. TEST, 2500 V.D.C. WORKING, MICA	-481170-10		2			T-7606233 P30		0	0	0	C-425, C-426
				CAPACITOR SPARE FOR C-425	SAME AS C-425, EXCEPT OMIT "E" BRACKET	-481170-10						5	1	1	1	
X	X	X	C-426	GAP SHUNT CAPACITOR	SAME AS C-425	-481170-10						5				
					MISCELLANEOUS (CLASS 10)											
X	X	X	E-211	H.V. BRUSH	BRUSH, MORGANITE #HM6165, USED ON 1000 V. GENERATOR			1	S#1133015		33-J-706 P55	2	60	60	60	E-211, E-221
X	X	X	E-212	L.V. BRUSH	BRUSH, STACKPOLE, WL-27 USED ON 275 V. GENERATOR			1	S#1133016		33-J-706 P56	2	20	20	20	E-212
X	X	X	E-213	SHUNT AND SERIES COILS	USED ON 1000/275 V. GENERATOR			1			L-372453	2	2	2	2	E-213
X	X	X	E-214	BRUSH HOLDER	USED ON 1000/275 V. GENERATOR			1	S#1124399		33-J-176 P37 TO 42, 52, 53	2	2	2	2	E-214, E-224
X	X	X	E-214A	BRUSH HOLDER SPRING	USED ON 1000/275 V. GENERATOR			1	S#848058		33-J-176 P42	2	3	3	3	E-214A, E-224A, E-246A, E-247A E-276A, E-277A
X	X	X	E-215A	BRUSH HOLDER INSULATOR	USED ON 1000/275 V. GENERATOR			8			33-J-176 P43	2	16	16	16	E-215A, E-225A
X	X	X	E-215B	FIBER WASHER	USED ON 1000/275 V. GENERATOR (BRUSH HOLDER INSULATION)			1			33-J-176 P54	2	32	32	32	E-215B, E-225B

TABLE II (CONTINUED)

PARTS AND SPARE PARTS LIST BY SYMBOL DESIGNATION FOR MODEL TBM-11 RADIO TRANSMITTING EQUIPMENT

SUPPLY 115 V.D.C.	SUPPLY 230 V.D.C.	SUPPLY 440/3/60	SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY SPEC. OR DRAWING NUMBER	MFR.	MFR. DESIG.	SPECIAL TOL RATING OR MODIFICATION	CONTRACTOR'S DRAWING AND PART NUMBER	SPARE PARTS BOX NUMBER	SPARE PARTS QUANTITY 115 V.D.C.	SPARE PARTS QUANTITY 230 V.D.C.	SPARE PARTS QUANTITY 440/3/60	SPARE PARTS ALL SYMBOL DESIGNATIONS INVOLVED
					MISCELLANEOUS (GLASS 10) CONTINUED											
			E-216													
X	X	X	E-217	L.V. GENERATOR ARMATURE	1000 VOLTS, 0.075 VOLTS, 0.92 AMPS.			1			33-J-176 P120	4	1	1	1	E-217
			E-218 TO E-220	NOT USED												
X	X	X	E-221	BRUSHES	SAME AS E-211							2				
X	X	X	E-222	SHUNT & SERIES COILS	UNSED ON 2000/3000 V. GENERATOR			1			L-372452	2	2	2	2	E-222
X	X	X	E-223	COMPOUND COMMUTATING COIL	USED ON 2000/3000 V. GENERATOR			1			L-372452	2	2	2	2	E-223
X	X	X	E-224	BRUSH HOLDER	SAME AS E-214							2				
X	X	X	E-224A	BRUSH HOLDER SPRING	SAME AS E-214A							2				
X	X	X	E-225A	ISOLANTITE INSULATOR	SAME AS E-215A							2				
X	X	X	E-225B	FIBER WASHER	SAME AS E-215B							2				
			E-226	NOT USED												
			E-227	NOT USED												
X	X	X	E-228	H.V. GENERATOR ARMATURE	2000 VOLTS, 0.75 AMP., 3000 VOLTS 0.35 AMP.			1			33-J-174 P33	3	1	1	1	E-228
	X		E-241	D.C. BRUSHES	STACKPOLE WL-27, USED ON 230 V.D.C. MOTOR			1	S#917122		33-J-178 P70	2	0	80	0	E-241
	X		E-242	A.C. BRUSHES	STACKPOLE WL-27, USED ON 230 V.D.C. MOTOR			1	S#1133017		33-J-178 P42	2	40	40	0	E-242,E-272
	X		E-243	COMMUTATING FIELD COILS	USED ON 230 V.D.C. MOTOR			1			L-367854	2	0	2	0	E-243
	X		E-244	SHUNT FIELD COILS	USED ON 230 V.D.C. MOTOR			1			L-367854	2	0	2	0	E-244
	X		E-245	D.C. BRUSH HOLDER	USED ON 230 V.D.C. MOTOR			1	S#271764		33-J-178 P122	2	0	2	0	E-245
	X		E-245A	D.C. BRUSH HOLDER SPRING	USED ON 230 V.D.C. MOTOR			1	S#282836		33-J-178 P74	2	3	3	0	E-245A,E-275A
	X		E-246	A.C. BRUSH HOLDER R.H.	USED ON 230 V.D.C. MOTOR			1	S#1124417		33-J-178 P120	2	2	2	0	E-246,E-276
	X		E-246A	A.C. BRUSH HOLDER SPRING	SAME AS E-214A							2				
	X		E-247	A.C. BRUSH HOLDER L.H.	USED ON 230 V.D.C. MOTOR			1	S#1124418		33-J-178 P121	2	0	2	0	E-247,E-277
	X		E-247A	A.C. BRUSH HOLDER SPRING	SAME AS E-214A							2				
	X		E-248	D.C. BRUSH HOLDER ROD INSULATION	USED ON 230 V.D.C. MOTOR			1			33-J-178 P64,P65 P113	2	0	1 SET	0	E-248
	X		E-249	A.C. BRUSH HOLDER ROD INSULATION	USED ON 230 V.D.C. MOTOR			1			33-J-178 P56 TO P59	2	0	1 SET	0	E-249

TABLE II (CONTINUED)

PARTS AND SPARE PARTS LIST BY SYMBOL DESIGNATION FOR MODEL TBM-11 RADIO TRANSMITTING EQUIPMENT

SUPPLY 115 V.D.C.	SUPPLY 230 V.D.C.	SUPPLY 440/3/60	SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY SPEC. OR DRAWING NUMBER	MFR.	MFR. DESIG.	SPECIAL TOL RATING OR MODIFICATION	CONTRACTOR'S DRAWING AND PART NUMBER	SPARE PARTS BOX NUMBER	SPARE PARTS QUANTITY 115 V.D.C.	SPARE PARTS QUANTITY 230 V.D.C.	SPARE PARTS QUANTITY 440/3/60	ALL SYMBOL DESIGNATIONS INVOLVED
					MISCELLANEOUS (CLASS 10) CONTINUED											
	X		E-250	MOTOR ARMATURE	230 VOLTS, 22 AMPS. D.C., 162 VOLTS 3.3 AMPS. A.C.			1			33-J-178 P117	6	0	1	0	E-250
X			E-271	D.C. BRUSHES	USED ON 115 V.D.C. MOTOR			1	S#916415		33-J-180 P70	2	80	0	0	E-271
X			E-272	A.C. BRUSHES	SAME AS E-242							2				
			E-273	NOT USED												
			E-274	NOT USED												
X			E-275A	D.C. BRUSH HOLDER SPRING	SAME AS E-245A							2				
X			E-276	A.C. BRUSH HOLDER R.H.	SAME AS E-246							2				
X			E-276A	A.C. BRUSH HOLDER SPRING	SAME AS E-214A							2				
X			E-277	A.C. BRUSH HOLDER L.H.	SAME AS E-247							2				
X			E-277A	A.C. BRUSH HOLDER SPRING	SAME AS E-214A							2				
X			E-278	D.C. BRUSH HOLDER ROD INS	USED ON 115 V.D.C. MOTOR			1			33-J-180 P64, P65, P113	2	1 SET	0	0	E-278
X			E-279	A.C. BRUSH HOLDER INSULATION	USED ON 115 V.D.C. MOTOR			1			33-J-180 P56, TO P59	2	1 SET	0	0	E-279
			E-280	NOT USED												
X			E-281	COMMUTATING FIELD COILS	USED ON 115 V.D.C. MOTOR			1			L-367855	2	2	0	0	E-281
X			E-282	SHUNT FIELD COILS	USED ON 115 V.D.C. MOTOR			1			L-367855	2	2	0	0	E-282
X			E-283	D.C. BRUSH HOLDER	USED ON 115 V.D.C. MOTOR			1	S#271765		33-J-180 P122	2	2	0	0	E-283
X			E-284	MOTOR ARMATURE	115 VOLTS, 44 AMPS D.C., 81 VOLTS, 6.6 AMPS A.C.			1			33-J-180 P117	6	1	0	0	E-284
					FUSES (CLASS 28)											
X	X	X	F-1	CONTROL CIRCUIT FUSE	6 AMPS., 250 VOLTS, NON-RENEWABLE		17-F-2G	9			T-7607281 P89	1	10	10	10	F-1, F-2
X	X	X	F-2	CONTROL CIRCUIT FUSE	SAME AS F-1							1				
		X	F-13	FILAMENT CIRCUIT FUSE	6 AMPS., 600 VOLTS, NON-RENEWABLE		17-F-2G	9			T-7607281 P93	1	0		10	F-13, F-14
		X	F-14	FILAMENT CIRCUIT FUSE	SAME AS F-13							1				
X	X	X	F-211	LOW VOLTAGE GENERATOR FUSE	0.25 AMP., 5000 VOLTS, NON-RENEWABLE			10	#3022C		33-J-176 P66	2	10	10	10	F-211

TABLE II (CONTINUED)

PARTS AND SPARE PARTS LIST BY SYMBOL DESIGNATION FOR MODEL TBW-11 RADIO TRANSMITTING EQUIPMENT

SUPPLY 115 V.D.C.	SUPPLY 230 V.D.C.	SUPPLY 440/3/60	SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY SPEC. OR DRAWING NUMBER	MFR.	MFR. DESIG.	SPECIAL TOL RATING OR MODIFICATION	CONTRACTOR'S DRAWING AND PART NUMBER	SPARE PARTS BOX NUMBER	SPARE PARTS QUANTITY 115 V.D.C.	SPARE PARTS QUANTITY 230 V.D.C.	SPARE PARTS QUANTITY 440/3/60	ALL SYMBOL DESIGNATIONS INVOLVED
					FUSES (CLASS 10) CONTINUED											
X	X	X	F-212	LOW VOLTAGE GENERATOR FUSE	3 AMPS., 250 VOLTS, NON-RENEWABLE		17-F-2	11	S#37155		33-J-176 P84	2	10	10	10	F-212, F-401, F-402
X	X	X	F-221	HIGH VOLTAGE GENERATOR FUSE	1 AMP., 5000 VOLTS, NON-RENEWABLE			10	#3025C		33-J-174 P92	2	10	10	10	F-221
X	X	X	F-222	HIGH VOLTAGE GENERATOR FUSE	2 AMPS., 5000 VOLTS, NON-RENEWABLE			10	#3026C		33-J-174 P93	2	10	10	10	F-222
X	X	X	F-401	FIL. & CONTROL CIRCUIT FUSE	SAME AS F-212							2				
X	X	X	F-402	FIL. & CONTROL CIRCUIT FUSE	SAME AS F-212							2				
X			F-841	CONTROL FUSE	10 AMPS., 250 VOLTS, NON-RENEWABLE			9	S#37160		45-J-406 P10	2	10	10	10	F-841, F-851, F-861
	X		F-851	CONTROL FUSE	SAME AS F-841							2				
		X	F-861	CONTROL FUSE	SAME AS F-841							2				
					HANDSET (CLASS 51)											
X	X	X	HS-401	HANDSET	COMBINATION MICROPHONE AND RECEIVER	-51050		12			P-7707248 G1		0	0	0	HS-401
					MISCELLANEOUS (CLASS 10)											
X	X	X	I-1A	BIAS INDICATOR LAMP	LIGHT RECEPTACLE			1	S#867328B		T-7607281 P102		0	0	0	I-1A, I-4A
X	X	X	I-1B	BULB	18 VOLTS, 0.11 AMPS.	TS-51		1	S#549474		T-7607281 P103	1	5	5	5	I-1B, I-2B, I-3B, I-4B, I-5B, I-6B
														X		I-1B, I-3B, I-4B I-5B, I-6B
													X		X	I-1B, I-2B, I-3B, I-4B, I-5B
X	X	X	I-1C	LENS	GREEN			1	S#549469		T-7607281 P104	1	1	1	1	I-1C
X		X	I-2A	M.G. INDICATOR LAMP	LIGHT RECEPTACLE, 1200 OHMS RESISTANCE WITH MOUNTING			1	S#867327B		T-7607281 P105	1	2	1	2	I-2A, I-3A, I-5A
													X		X	I-2A, I-3A, I-5A
X		X	I-2B	BULB	SAME AS I-1B							1		X		I-3A, I-5A
X		X	I-2C	LENS	RED			1	S#549468		T-7607281 P107	1	2	2	2	I-2C, I-3C, I-6C
													X		X	I-2C, I-3C
														X		I-3C, I-6C
X	X	X	I-3A	PLATE VOLTAGE INDICATOR LAMP	SAME AS I-2A							1				
X	X	X	I-3B	BULB	SAME AS I-1B	TS-51						1				
X	X	X	I-3C	LENS	SAME AS I-2C, RED							1				

TABLE II (CONTINUED)

PARTS AND SPARE PARTS LIST BY SYMBOL DESIGNATION FOR MODEL TBM-11 RADIO TRANSMITTING EQUIPMENT

SUPPLY 115 V.D.C.	SUPPLY 230 V.D.C.	SUPPLY 440/3/60	SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY SPEC. OR DRAWING NUMBER	MFR.	MFR. DESIG.	SPECIAL TOL RATING OR MODIFICATION	CONTRACTOR'S DRAWING AND PART NUMBER	SPARE PARTS BOX NUMBER	SPARE PARTS QUANTITY 115 V.D.C.	SPARE PARTS QUANTITY 230 V.D.C.	SPARE PARTS QUANTITY 440/3/60	ALL SYMBOL DESIGNATIONS INVOLVED
					MISCELLANEOUS (CLASS 10) CONTINUED											
X	X	X	I-4A	INDICATOR LAMP	SAME AS I-1A								0	0	0	
X	X	X	I-4B	BULB	SAME AS I-1B	TS-51						1	0	0	0	
X	X	X	I-4C	LENS	CLEAR			1	S#549470		T-7607281 P113	1	1	1	1	I-4C
X	X	X	I-5A	M.O. HEATER INDICATOR LAMP	SAME AS I-2A							1				
X	X	X	I-5B	BULB	SAME AS I-1B	TS-51						1				
X	X	X	I-5C	LENS	AMBER			1	S#549472		T-7607281 P116	1	1	1	1	I-5C
	X		I-6A	M.G. INDICATOR LAMP	LIGHT RECEPTACLE, 2600 OHMS WITH MOUNTING			1	S#867325B		T-7607281 P120	1	0	1	0	I-6A
	X		I-6B	BULB	SAME AS I-1B	TS-51						1				
	X		I-6C	LENS	SAME AS I-2C, RED							1				
X	X	X	I-401A	PLATE VOLTAGE INDICATOR LAMP	SAME AS I-2A							5	1	1	1	I-401A, I-403A
X	X	X	I-401B	LENS	SAME AS I-2C, RED							5	2	2	2	I-401B, I-403B
X	X	X	I-401C	BULB	SAME AS I-1B	TS-51						5	3	3	3	I-401C, I-402C, I-403C
X	X	X	I-402A	BIAS VOLTAGE INDICATOR LAMP	SAME AS I-6A							5	1	1	1	I-402A
X	X	X	I-402B	LENS	SAME AS I-1C, GREEN							5	1	1	1	I-402B
X	X	X	I-402C	BULB	SAME AS I-1B	TS-51						5				
X	X	X	I-403A	START INDICATOR LIGHT	SAME AS I-2A							5				
X	X	X	I-403B	LENS	SAME AS I-2C, RED							5				
X	X	X	I-403C	BULB	SAME AS I-1B							5				
					JACKS (CLASS 49)											
X	X	X	J-1	FREQUENCY METER PHONE JACK	JACK AND CUP ASSEMBLY (INCLUDES -49021A)	-49110	RE49AA147A	13			T-7607281 P124		0	0	0	J-1
					JACK ONLY, TWO CIRCUIT NORMALLY CLOSED	-49021A	RE13A481D	11								
					RELAYS AND CONTACTORS (CLASS 29)											
X	X	X	K-1	KEYING RELAY	D.P.S.T., PLUS S.P.D.T., TWO BREAKS PER CIRCUIT, NORMALLY THREE CIRCUIT OPEN AND ONE CIRCUIT CLOSED	-29169		1			T-7604741 G12		0	0	0	K-1

TABLE II (CONTINUED)

PARTS AND SPARE PARTS LIST BY SYMBOL DESIGNATION FOR MODEL TBM-11 RADIO TRANSMITTING EQUIPMENT

SUPPLY 115 V.D.C.	SUPPLY 230 V.D.C.	SUPPLY 440/3/60	SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY SPEC. OR DRAWING NUMBER	MFR.	MFR. DESIG.	SPECIAL TOL RATING OR MODIFICATION	CONTRACTOR'S DRAWING AND PART NUMBER	SPARE PARTS BOX NUMBER	SPARE PARTS QUANTITY 115 V.D.C.	SPARE PARTS QUANTITY 230 V.D.C.	SPARE PARTS QUANTITY 440/3/60	ALL SYMBOL DESIGNATIONS INVOLVED
				RELAYS AND CONTACTORS (CLASS 29) CONTINUED												
X	X	X	K-1A	COIL, FOR RELAY K-1	13,200 TURNS OF #34 WIRE, 0.1 AMP. ±15 AT 75 V.D.C. (50 TO 100 V. RANGE)			1			P-7703524 G13	1	1	1	1	K-1A
X	X	X	K-1B	CONTACT - STATIONARY	FOR RELAY K-1			1	S#867059		T-7604479 G3	1	4	4	4	K-1B, K-1E
X	X	X	K-1B	CONTACT - MOVING	FOR RELAY K-1			1			P-7705894 G1	1	4	4	4	K-1B, K-1E
X	X	X	K-1C	CONTACT - STATIONARY	FOR RELAY K-1			1	S#867058		T-7604479 G2	1	4	4	4	K-1C, K-1D
X	X	X	K-1C	CONTACT - MOVING	FOR RELAY K-1			1			M-7406884 G1	1	4	4	4	K-1C, K-1D
X	X	X	K-1D	CONTACT - STATIONARY	SAME AS K-1C, STA.							1				
X	X	X	K-1D	CONTACT - MOVING	SAME AS K-1C, MOV.							1				
X	X	X	K-1E	CONTACT - STATIONARY	SAME AS K-1B, STA.							1				
X	X	X	K-1E	CONTACT - MOVING	SAME AS K-1B, MOV.							1				
X	X	X	K-2	COMPENSATOR RELAY	S.P.D.T., SINGLE BREAK PER CIRCUIT 0.005 AMP. AT 50 VOLTS D.C. NORMALLY OPERATES AT 75 V.D.C. ±20% WITH 5000 OHMS SERIES RESISTOR	-29058		14	CXA-2119		T-7607281 P139		0	0	0	K-2
X	X	X	K-2A	COIL FOR RELAY K-2	0.005 AMP. 50 V.D.C. NORMALLY OPERATES AT 75 V.D.C. ±20% WITH 5000 OHMS SERIES RESISTOR, D.C. RESISTANCE 10,000 OHMS			14	TYPE V		T-7607281 P140	1	1	1	1	K-2A
X	X	X	K-2B	CONTACT - STATIONARY	2 AMPS. AT 110 V.A.C.			14	#2964		T-7607281 P141	1	4 X	4 X	4 X	K-2B, K-8B, K-20B K-2B, K-20B K-2B, K-8B
X	X	X	K-2B	CONTACT - MOVING & SPRING	2 AMPS. AT 110 V.A.C.			14	#2071		T-7607281 P142	1	4 X	4 X	4 X	K-2B, K-8B, K-20B K-2B, K-20B K-2B, K-8B
			K-3	NOT USED												
X	X		K-4	MAIN STARTING RELAY	4 P.S.T., DOUBLE BREAK, 3 POLES NORMALLY OPEN, 1 POLE NORMALLY CLOSED	-29064		1	TYPE 5-FN S#1264017A		9-A-3882 L-2		0	0	0	K-4
X	X		K-4A	COIL FOR RELAY K-4	6000 TURNS #30 D.C.C. WIRE, D.C. RESISTANCE 344 OHMS			1	S#897943		9-A-3882 P38	1	1	1	0	K-4A
X	X		K-4B	CONTACT - STATIONARY	5 AMPS. AT 220 VOLTS			1	S#897644		9-A-3882 P5	1	4 X	4 X	4 X	K-4B, K-4C, K-4D, K-9B, K-9C, K-14B, K-14C, K-14D, K-14E, K-14F, K-19B, K-19C K-4B, K-4C, K-4D, K-9B, K-9C K-14B, K-14C, K-14D K-14E, K-14F, K-19B K-19C

TABLE II (CONTINUED)

PARTS AND SPARE PARTS LIST BY SYMBOL DESIGNATION FOR MODEL TBM-11 RADIO TRANSMITTING EQUIPMENT

SUPPLY 115 V.D.C.	SUPPLY 230 V.D.C.	SUPPLY 440/3/60	SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY SPEC. OR DRAWING NUMBER	MFR.	MFR. DESIG.	SPECIAL TOL RATING OR MODIFICATION	CONTRACTOR'S DRAWING AND PART NUMBER	SPARE PARTS BOX NUMBER	SPARE PARTS QUANTITY 115 V.D.C.	SPARE PARTS QUANTITY 230 V.D.C.	SPARE PARTS QUANTITY 440/3/60	SPARE PARTS ALL SYMBOL DESIGNATIONS INVOLVED
					RELAYS AND CONTACTORS (CLASS 29) CONTINUED											
X	X		K-4B	CONTACT - MOVING	5 AMPS. AT 220 VOLTS			1	S#897622		9-A-3882 P4	1	4	4	4	K-4B,K-4C,K-4D, K-9B,K-9C,K-14B, K-14C,K-14D,K-14E, K-14F,K-19B,K-19C
													X	X		K-4B,K-4C,K-4D, K-9B,K-9C
															X	K-14B,K-14C,K-14D K-14E,K-14F,K-19B K-19C
X	X		K-4C	CONTACT - STATIONARY	SAME AS K-4B, STA.							1				
X	X		K-4C	CONTACT - MOVING	SAME AS K-4B, MOV.							1				
X	X		K-4D	CONTACT - STATIONARY	SAME AS K-4B, STA.							1				
X	X		K-4D	CONTACT - MOVING	SAME AS K-4B, MOV.							1				
X	X	X	K-5	H.V. OVERLOAD RELAY	S.P.S.T., ONE BREAK PER CIRCUIT, NORMALLY CLOSED, SLOW ACTION, MANUAL RESET, 0.75 TO 3 AMPS. OPERATING RANGE	-29195		1	S#1164031 TYPE MN		P-7710114 P3		0	0	0	K-5
X	X	X	K-5A	COIL FOR RELAY K-5	OPERATING RANGE 0.75 TO 3 AMPS. D.C. RESISTANCE 1.6 OHMS			1	S#1164028			1	1	1	1	K-5A
X	X	X	K-5B	CONTACT - STATIONARY	FOR RELAY K-5, 0.5 AMP. 230 V.A.C. OR D.C.			1	S#1202083			1	4	4	4	K-5B,K-7B
X	X	X	K-5B	CONTACT - MOVING	FOR RELAY K-5, 0.5 AMP. 230 V.A.C. OR D.C.			1	S#1202082			1	4	4	4	K-5B,K-7B
			K-6	NOT USED												
X	X	X	K-7	LOW VOLTAGE OVERLOAD RELAY	S.P.S.T., ONE BREAK PER CIRCUIT, NORMALLY CLOSED, 0.15 TO 0.6 AMP. OPERATING RANGE	-29196		1	S#1164029 TYPE MN		P-7710114 P1		0	0	0	K-7
X	X	X	K-7A	COIL FOR RELAY K-7	OPERATING RANGE 0.15 TO 0.6 AMP. D.C. RESISTANCE 42 OHMS			1	S#1164026			1	1	1	1	K-7A
X	X	X	K-7B	CONTACT - STATIONARY	SAME AS K-5B, STA.							1				
X	X	X	K-7B	CONTACT - MOVING	SAME AS K-5B, MOV.							1				
		X	K-8	THERMOSTAT RELAY	S.P.S.T., ONE BREAK PER CIRCUIT, NORMALLY CLOSED			14			T-7609921 P5		0	0	0	K-8
		X	K-8A	COIL FOR RELAY K-8	11 V.A.C. ±10%, FOR RELAY CX-2120			14	COIL TYPE AB		T-7607282 P163	1	0	0	1	K-8A
		X	K-8B	CONTACT - STATIONARY	SAME AS K-2B, STA.							1				
		X	K-8B	CONTACT - MOVING	SAME AS K-2B, MOV.							1				

TABLE II (CONTINUED)

PARTS AND SPARE PARTS LIST BY SYMBOL DESIGNATION FOR MODEL TBM-11 RADIO TRANSMITTING EQUIPMENT

SUPPLY 115 V.D.C.	SUPPLY 230 V.D.C.	SUPPLY 440/3/60	SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY SPEC. OR DRAWING NUMBER	MFR.	MFR. DESIG.	SPECIAL TOL RATING OR MODIFICATION	CONTRACTOR'S DRAWING AND PART NUMBER	SPARE PARTS BOX NUMBER	SPARE PARTS QUANTITY 115 V.D.C.	SPARE PARTS QUANTITY 230 V.D.C.	SPARE PARTS QUANTITY 440/3/60	ALL SYMBOL DESIGNATIONS INVOLVED
					RELAYS AND CONTACTORS (CLASS 29) CONTINUED											
X	X		K-9	FIELD CIRCUIT RELAY	D.P.S.T., TWO BREAKS PER CIRCUIT, NORMALLY OPEN	-29062		1	S#1264016A TYPE 5FN		9-A-3882 L1		0	0	0	K-9
X	X		K-9A	COIL FOR RELAY K-9	12000 TURNS #33 WIRE, D.C. RESISTANCE 1375 OHMS			1	S#875799		9-A-3882 P37	1	1	1	0	K-9A
X	X		K-9B	CONTACT - STATIONARY	SAME AS K-4B, STA.							1				
X	X		K-9B	CONTACT - MOVING	SAME AS K-4B, MOV.							1				
X	X		K-9C	CONTACT - STATIONARY	SAME AS K-4B, STA.							1				
X	X		K-9C	CONTACT - MOVING	SAME AS K-4B, MOV.							1				
			K-10 TO K-13	NOT USED												
		X	K-14	MAIN STARTING RELAY	3 P.D.T., THREE MAKE AND TWO BREAK, THREE POLES NORMALLY OPEN, AND TWO POLES NORMALLY CLOSED, 60 VOLTS, 60 CYCLE	-29129		1	S#1289091 TYPE FN		9-A-3882 L11		0	0	0	K-14
		X	K-14A	COIL FOR RELAY K-14	60 VOLTS, 60 CYCLE, 3 OHMS D.C.			1	S#1128913		T-7607282 P173	1	0	0	1	K-14A
		X	K-14B	CONTACT - STATIONARY	SAME AS K-4B, STA.							1				
		X	K-14B	CONTACT - MOVING	SAME AS K-4B, MOV.							1				
		X	K-14C	CONTACT - STATIONARY	SAME AS K-4B, STA.							1				
		X	K-14C	CONTACT - MOVING	SAME AS K-4B, MOV.							1				
		X	K-14D	CONTACT - STATIONARY	SAME AS K-4B, STA.							1				
		X	K-14D	CONTACT - MOVING	SAME AS K-4B, MOV.							1				
		X	K-14E	CONTACT - STATIONARY	SAME AS K-4B, STA.							1				
		X	K-14E	CONTACT - MOVING	SAME AS K-4B, MOV.							1				
		X	K-14F	CONTACT - STATIONARY	SAME AS K-4B, STA.							1				
		X	K-14F	CONTACT - MOVING	SAME AS K-4B, MOV.							1				
			K-15 TO K-18	NOT USED												
		X	K-19	FIELD CIRCUIT RELAY	D.P.S.T., TWO BREAKS PER CIRCUIT, NORMALLY OPEN, COIL RATING 0.085 AMP. 110 V. ±10%, 60 CYCLE	-29063		1	S#1264018A TYPE FN		9-A-3882 L3		0	0	0	K-19
		X	K-19A	COIL FOR RELAY K-19	110 V. ±10%, 60 CYCLE, 0.085 AMP., D.C RESISTANCE 6.5 OHMS			1	S#874114			1	0	0	1	K-19A

TABLE II (CONTINUED)

PARTS AND SPARE PARTS LIST BY SYMBOL DESIGNATION FOR MODEL TBM-11 RADIO TRANSMITTING EQUIPMENT

SUPPLY 115 V.D.C.	SUPPLY 230 V.D.C.	SUPPLY 440/3/60	SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY SPEC. OR DRAWING NUMBER	MFR.	MFR. DESIG.	SPECIAL TOL RATING OR MODIFICATION	CONTRACTOR'S DRAWING AND PART NUMBER	SPARE PARTS BOX NUMBER	SPARE PARTS QUANTITY 115 V.D.C.	SPARE PARTS QUANTITY 230 V.D.C.	SPARE PARTS QUANTITY 440/3/60	ALL SYMBOL DESIGNATIONS INVOLVED
					RELAYS AND CONTACTORS (CLASS 29) CONTINUED											
		X	K-19B	CONTACT - STATIONARY	SAME AS K-4B, STA.							1				
		X	K-19B	CONTACT - MOVING	SAME AS K-4B, MOV.							1				
		X	K-19C	CONTACT - STATIONARY	SAME AS K-4B, STA.							1				
		X	K-19C	CONTACT - MOVING	SAME AS K-4B, MOV.							1				
X	X		K-20	THERMOSTAT RELAY	SINGLE CIRCUIT NORMALLY CLOSED, COIL TO OPERATE AT 11 V.D.C. -23% +45%, CONTACTS TO MAKE AND BREAK			14	CX-1968		T-7609921 P1		0	0	0	K-20
X	X		K-20A	COIL FOR RELAY K-20	11 V.D.C. -23%, +45%, 12 MILLIAMPS			14	COIL 1		T-7609921 P1	1	1	1	0	K-20A
X	X		K-20B	CONTACT - STATIONARY	SAME AS K-2B, STA.							1				
X	X		K-20B	CONTACT - MOVING	SAME AS K-2B, MOV.							1				
X	X	X	K-401	VOICE RELAY	S.P.D.T., ONE BREAK PER CIRCUIT, CONTACT RATING 2 AMPS., 110 VOLTS, CONTACT GAP 0.025", DROP OUT TIME 0.006 SECONDS, COIL CURRENT 6 MILLIAMPS (PICKUP)	-29091		15	CAT #220937		T-7606218 P4		0	0	0	K-401
X	X	X	K-401A	CONTACT - STATIONARY	FOR RELAY K-401			15			T-7606286 P38	5	4	4	4	K-401A
X	X	X	K-401B	CONTACT - MOVING	FOR RELAY K-401			15			T-7606286 P39	5	4	4	4	K-401B
X	X	X	K-401C	COIL FOR RELAY K-401	MAXIMUM RESISTANCE 1800 OHMS, CURRENT 6 MILLIAMPS			15			T-7606286 P57	5	1	1	1	K-401C
X			K-841	LINE CONTACTOR	TYPE IM-220 CONTACTOR			1			45-J-406 P1		0	0	0	K-841, K-851
X			K-841A	COIL FOR CONTACTOR K-841	1760 TURNS #30 WIRE, 55 OHMS, PLUS 13350 TURNS #30 WIRE, 1210 OHMS			1	S#1303531		37-J-922 P5	2	1	0	0	K-841A
X			K-841B	MAIN CONTACT STATIONARY	FOR RELAY K-841			1	S#1303972		37-J-922 P1	2	2 X	2 X	0	K-841B, K-841C, K-851B, K-851C K-841B, K-841C K-851B, K-851C
X			K-841B	CONTACT - MOVING	FOR RELAY K-841			1	S#1303971		37-J-922 P2	2	2 X	2 X	0	K-841B, K-841C, K-851B, K-851C K-841B, K-841C K-851B, K-851C
X			K-841C	MAIN CONTACT - STATIONARY	SAME AS K-841B, STA							2				
X			K-841C	MAIN CONTACT - MOVING	SAME AS K-841B, MOV.							2				
X			K-841D	CONTACT - STATIONARY	FOR RELAY K-841			1	S#1308214		37-J-922 P9	2	2 X	2 X	0	K-841D, K-851D K-841D K-851D

TABLE II (CONTINUED)

PARTS AND SPARE PARTS LIST BY SYMBOL DESIGNATION FOR MODEL TBM-11 RADIO TRANSMITTING EQUIPMENT

SUPPLY 115 V.D.C.	SUPPLY 230 V.D.C.	SUPPLY 440/3/60	SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY SPEC. OR DRAWING NUMBER	MFR.	MFR. DESIG.	SPECIAL TOL RATING OR MODIFICATION	CONTRACTOR'S DRAWING AND PART NUMBER	SPARE PARTS BOX NUMBER	SPARE PARTS QUANTITY 115 V.D.C.	SPARE PARTS QUANTITY 230 V.D.C.	SPARE PARTS QUANTITY 440/3/60	ALL SYMBOL DESIGNATIONS INVOLVED
					RELAYS AND CONTACTORS (CLASS 29) CONTINUED											
X			K-841D	CONTACT - MOVING	FOR RELAY K-841			1	S#1308317			2	1 X	1 X	0	K-841D,K-851D K-841D K-851D
X			K-841E	CONTACT - STATIONARY	FOR RELAY K-841			1	S#1308250		37-J-922 P6	2	2 X	2 X	0	K-841E,K-851E K-841E K-851E
X			K-841E	CONTACT - MOVING	FOR RELAY K-841			1	S#1308251		37-J-922 P7	2	1 X	1 X	0	K-841E,K-851E K-841E K-851E
X			K-841F	CONTACT - STATIONARY	FOR RELAY K-841			1	S#1308181		37-J-922 P12	2	2 X	2 X	0	K-841F,K-851F K-841F K-851F
X			K-841F	CONTACT - MOVING	FOR RELAY K-841			1	S#1257419		37-J-922 P13	2	1 X	1 X	0	K-841F,K-851F K-841F K-851F
X			K-841G	MAIN CONTACT SPRING	FOR RELAY K-841			1	S#1308159		37-J-922 P3	2	2 X	2 X	0	K-841G,K-851G K-841G K-851G
X			K-841H	KICK-OUT SPRING	FOR RELAY K-841			1	S#1308163		37-J-922 P4	2	1 X	1 X	0	K-841H,K-851H K-841H K-851H
X			K-841J	INTERLOCK SPRING	FOR RELAY K-841			1	S#1308164		37-J-922 P8	2	1 X	1 X	0	K-841J,K-851J K-841J K-851J
X			K-841K	INTERLOCK SPRING	FOR RELAY K-841			1	S#1297369		37-J-922 P11	2	1 X	1 X	0	K-841K,K-851K K-841K K-851K
X			K-841L	INTERLOCK SPRING	FOR RELAY K-841			1	S#1289042		37-J-922 P14	2	1 X	1 X	0	K-841L,K-851L K-841L K-851L
X			K-842	ACCELERATING CONTACTOR	TYPE 1AQ-4111 RELAY WITH 1NO AND 1NC CONTROL CONTACT			1			45-J-406 P6		0 X	0 X	0	K-842,K-843,K-852,K-853 K-842,K-843 K-852,K-853
X			K-842A	COIL FOR CONTACTOR K-842	4000 TURNS #31 WIRE, 246 OHMS PLUS 2052 TURNS #33 WIRE, 250 OHMS			1	S#1315390		37-J-890 P5	2	1	0	0	K-842A,K-843A
X			K-842B	MAIN CONTACT STATIONARY	FOR CONTACTOR K-842			1	S#1308318		37-J-890 P2	2	2 X	2 X	0	K-842B,K-843B,K-852B,K-853B K-842B,K-843B K-852B,K-853B

TABLE II (CONTINUED)

PARTS AND SPARE PARTS LIST BY SYMBOL DESIGNATION FOR MODEL TBM-11 RADIO TRANSMITTING EQUIPMENT

SUPPLY 115 V.D.C.	SUPPLY 230 V.D.C.	SUPPLY 440/3/60	SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY SPEC. OR DRAWING NUMBER	MFR.	MFR. DESIG.	SPECIAL TOL RATING OR MODIFICATION	CONTRACTOR'S DRAWING AND PART NUMBER	SPARE PARTS BOX NUMBER	SPARE PARTS QUANTITY 115 V.D.C.	SPARE PARTS QUANTITY 230 V.D.C.	SPARE PARTS QUANTITY 440/3/60	SPARE PARTS ALL SYMBOL DESIGNATIONS INVOLVED
					RELAYS AND CONTACTORS (CLASS 29) CONTINUED											
X			K-842B	MAIN CONTACT - MOVING	FOR CONTACTOR K-842			1	S#1308318		37-J-890 P1	2	2	2	0	K-842B,K-843B,K-852B K-853B
													X			K-842B,K-843B
														X		K-852B,K-853B
X			K-842C	CONTACT - STATIONARY	FOR CONTACTOR K-842			1	S#1258707		37-J-890 P6	2	4	4	0	K-842C,K-843C, K-852C,K-853C
													X			K-842C,K-843C
														X		K-852C,K-853C
X			K-842C	CONTACT - MOVING	FOR CONTACTOR-K-842			1	S#1257419		37-J-890 P7	2	2	2	0	K-842C,K-843C, K-852C,K-853C
													X			K-842C,K-843C
														X		K-852C,K-853C
X			K-842D	CONTACT - STATIONARY	FOR CONTACTOR K-842			1	S#1258708		37-J-890 P9	2	4	4	0	K-842D,K-843D, K-852D,K-853D
													X			K-842D,K-843D
														X		K-852D,K-853D
X			K-842D	CONTACT - MOVING	FOR CONTACTOR K-842			1	S#1312152		37-J-890 P10	2	2	2	0	K-842D,K-843D, K-852D,K-853D
													X			K-842D,K-843D
														X		K-852D,K-853D
X			K-842E	CONTACT SPRING	FOR CONTACTOR K-842			1	S#1312162		37-J-890 P11	2	2	2	0	K-842E,K-843E, K-852E,K-853E
													X			K-842E,K-843E
														X		K-852E,K-853E
X			K-842F	RETURN SPRING	FOR CONTACTOR K-842			1	S#1258957		37-J-890 P3	2	2	2	0	K-842F,K-843F, K-852F,K-853F
													X			K-842F,K-843F
														X		K-852F,K-853F
X			K-842G	ARMATURE SPRING	FOR CONTACTOR K-842			1	S#1258963		37-J-890 P4	2	2	2	0	K-842G,K-843G, K-852G,K-853G
													X			K-842G,K-843G
														X		K-852G,K-853G
X			K-842H	CONTACT SPRING	FOR CONTACTOR K-842			1	S#1289042		37-J-890 P8	2	2	2	0	K-842H,K-843H, K-852H,K-853H
													X			K-842H,K-843H
														X		K-852H,K-853H
X			K-843	ACCELERATING CONTACTOR	SAME AS K-842								0	0	0	
X			K-843A	COIL FOR CONTACTOR K-843	SAME AS K-842A							2				
X			K-843B	MAIN CONTACT - STATIONARY	SAME AS K-842B, STA.							2				
X			K-843B	MAIN CONTACT - MOVING	SAME AS K-842B, MOV.							2				
X			K-843C	MAIN CONTACT - STATIONARY	SAME AS K-842B, STA.							2				

TABLE II (CONTINUED)

PARTS AND SPARE PARTS LIST BY SYMBOL DESIGNATION FOR MODEL TBM-11 RADIO TRANSMITTING EQUIPMENT

SUPPLY 115 V.D.C.	SUPPLY 230 V.D.C.	SUPPLY 440/3/60	SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY SPEC. OR DRAWING NUMBER	MFR.	MFR. DESIG.	SPECIAL TOL RATING OR MODIFICATION	CONTRACTOR'S DRAWING AND PART NUMBER	SPARE PARTS BOX NUMBER	SPARE PARTS QUANTITY 115 V.D.C.	SPARE PARTS QUANTITY 230 V.D.C.	SPARE PARTS QUANTITY 440/3/60	ALL SYMBOL DESIGNATIONS INVOLVED
				RELAYS AND CONTACTORS (CLASS 29) CONTINUED												
X			K-843C	CONTACT - MOVING	SAME AS K-842C, MOV.							2				
X			K-843D	CONTACT - STATIONARY	SAME AS K-842D, STA.							2				
X			K-843D	CONTACT - MOVING	SAME AS K-842D, MOV.							2				
X			K-843E	CONTACT SPRING	SAME AS K-842E							2				
X			K-843F	RETURN SPRING	SAME AS K-842F							2				
X			K-843G	ARMATURE SPRING	SAME AS K-842G							2				
X			K-843H	CONTACT SPRING	SAME AS K-842H							2				
X			K-844	M.I. OVERLOAD RELAY				1			45-J-406 P12		0	0	0	K-844
X			K-844A	HEATER FOR K-844	53 AMPS.			1	S#1265734		36-J-639 P22	2	1	0	0	K-844A
	X		K-851	LINE CONTACTOR	SAME AS K-841								0	0	0	
	X		K-851A	COIL FOR CONTACTOR K-851	3520 TURNS #33 WIRE, 2000 OHMS PLUS 28700 TURNS #36 WIRE, 4850 OHMS			1	S#1303532		37-J-922 P5	2	0	1	0	K-851A
	X		K-851B	MAIN CONTACT - STATIONARY	SAME AS K-841B, STA.							2				
	X		K-851B	MAIN CONTACT - MOVING	SAME AS K-841B, MOV.							2				
	X		K-851C	MAIN CONTACT - STATIONARY	SAME AS K-841B, STA.							2				
	X		K-851C	MAIN CONTACT - MOVING	SAME AS K-841B, MOV.							2				
	X		K-851D	CONTACT - STATIONARY	SAME AS K-841D, STA.							2				
	X		K-851D	CONTACT - MOVING	SAME AS K-841D, MOV.							2				
	X		K-851E	CONTACT - STATIONARY	SAME AS K-841E, STA.							2				
	X		K-851E	CONTACT - MOVING	SAME AS K-841E, MOV.							2				
	X		K-851F	CONTACT - STATIONARY	SAME AS K-841F, STA.							2				
	X		K-851F	CONTACT - MOVING	SAME AS K-841F, MOV.							2				
	X		K-851G	MAIN CONTACT SPRING	SAME AS K-841G							2				
	X		K-851H	KICK-OUT SPRING	SAME AS K-841H							2				
	X		K-851J	INTERLOCK SPRING	SAME AS K-841J							2				
	X		K-851K	INTERLOCK SPRING	SAME AS K-841K							2				
	X		K-851L	INTERLOCK SPRING	SAME AS K-841L							2				

TABLE II (CONTINUED)

PARTS AND SPARE PARTS LIST BY SYMBOL DESIGNATION FOR MODEL TBM-11 RADIO TRANSMITTING EQUIPMENT

SUPPLY 115 V.D.C.	SUPPLY 230 V.D.C.	SUPPLY 440/3/60	SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY SPEC. OR DRAWING NUMBER	MFR.	MFR. DESIG.	SPECIAL TOL RATING OR MODIFICATION	CONTRACTOR'S DRAWING AND PART NUMBER	SPARE PARTS BOX NUMBER	SPARE PARTS QUANTITY 115 V.D.C.	SPARE PARTS QUANTITY 230 V.D.C.	SPARE PARTS QUANTITY 440/3/60	ALL SYMBOL DESIGNATIONS INVOLVED
					RELAYS AND CONTACTORS (CLASS 29) CONTINUED											
	X		K-852	ACCELERATING CONTACTOR	SAME AS K-842							2				
	X		K-852A	COIL FOR CONTACTOR K-852	8000 TURNS #34 WIRE, 9800 OHMS PLUS 2100 TURNS #36 WIRE, 500 OHMS			1	S#1315391		37-J-890 P5	2	0	1	0	K-852A, K-853A
	X		K-852B	MAIN CONTACT- STATIONARY	SAME AS K-842B, STA.							2				
	X		K-852B	MAIN CONTACT - MOVING	SAME AS K-842B, MOV.							2				
	X		K-852C	CONTACT - STATIONARY	SAME AS K-842C, STA.							2				
	X		K-852C	CONTACT - MOVING	SAME AS K-842C, MOV.							2				
	X		K-852D	CONTACT - STATIONARY	SAME AS K-842D, STA.							2				
	X		K-852D	CONTACT - MOVING	SAME AS K-842D, MOV.							2				
	X		K-852E	CONTACT SPRING	SAME AS K-842E							2				
	X		K-852F	RETURN SPRING	SAME AS K-842F							2				
	X		K-852G	ARMATURE SPRING	SAME AS K-842G							2				
	X		K-852H	CONTACT SPRING	SAME AS K-842H							2				
	X		K-853	ACCELERATING CONTACTOR	SAME AS K-842							2				
	X		K-853A	COIL FOR CONTACTOR K-853	SAME AS K-852A							2				
	X		K-853B	MAIN CONTACT - STA.	SAME AS K-842B, STA.							2				
	X		K-853B	MAIN CONTACT - MOV.	SAME AS K-842B, MOV.							2				
	X		K-853C	CONTACT - STATIONARY	SAME AS K-842C, STA.							2				
	X		K-853C	CONTACT - MOVING	SAME AS K-842C, MOV.							2				
	X		K-853D	CONTACT - STATIONARY	SAME AS K-842D, STA.							2				
	X		K-853D	CONTACT - MOVING	SAME AS K-842D, MOV.							2				
	X		K-853E	CONTACT SPRING	SAME AS K-842E							2				
	X		K-853F	RETURN SRPING	SAME AS K-842F							2				
	X		K-853G	ARMATURE SPRING	SAME AS K-842G							2				
	X		K-853H	CONTACT SPRING	SAME AS K-842H							2				
	X		K-854	M.I. OVERLOAD RELAY				1			45-J-408 P12		0	0	0	K-854
	X		K-854A	HEATER	26.0 AMPS.			1	S#1265727		36-J-639 P22	2	0	1	0	K-854A
		X	K-861	LINE CONTACTOR	TYPE IDN-130			1			45-J-450 P1		0	0	0	K-861
		X	K-861A	MAGNET COIL	1485 TURNS #28 WIRE, 37.8 OHMS			1	S#1303514		36-J-643 P5	2	0	0	1	K-861A
		X	K-861B	CONTACT - STATIONARY	FOR CONTACTOR K-861			1	S#1190278		36-J-643 P1	2	0	0	6	K-861B, K-861C, K-861D

TABLE II (CONTINUED)

PARTS AND SPARE PARTS LIST BY SYMBOL DESIGNATION FOR MODEL TBM-11 RADIO TRANSMITTING EQUIPMENT

SUPPLY 115 V.D.C.	SUPPLY 230 V.D.C.	SUPPLY 440/3/60	SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY SPEC. OR DRAWING NUMBER	MFR.	MFR. DESIG.	SPECIAL TOL RATING OR MODIFICATION	CONTRACTOR'S DRAWING AND PART NUMBER	SPARE PARTS BOX NUMBER	SPARE PARTS QUANTITY 115 V.D.C.	SPARE PARTS QUANTITY 230 V.D.C.	SPARE PARTS QUANTITY 440/3/60	SPARE PARTS ALL SYMBOL DESIGNATIONS INVOLVED
					RELAYS AND CONTACTORS (CLASS 29) CONTINUED											
		X	K-861B	CONTACT - MOVING	FOR CONTACTOR K-861			1	S#1190279		36-J-643 P2	2	0	0	3	K-861B, K-861C, K-861D
		X	K-861C	CONTACT - STATIONARY	SAME AS K-861B, STA.							2				
		X	K-861C	CONTACT - MOVING	SAME AS K-861B, MOV.							2				
		X	K-861D	CONTACT - STATIONARY	SAME AS K-861B, STA.							2				
		X	K-861D	CONTACT - MOVING	SAME AS K-861B, MOV.							2				
		X	K-861E	CONTACT SPRING	FOR CONTACTOR K-861			1	S#944780		36-J-643 P4	2	0	0	3	K-861E
		X	K-862	OVERLOAD RELAY	TYPE MI			1			45-J-405 P5		0	0	0	K-862
		X	K-862A	OVERLOAD RELAY HEATER	8.7 AMPS.			1	S#1265718		36-J-639 P22	2	0	0	2	K-862A, K-862B
		X	K-862B	OVERLOAD RELAY HEATER	SAME AS K-862A							2				
					REACTORS (CLASS 30) AND INDUCTORS & CHOKES (CLASS 47)											
X	X	X	L-1	M.O. TANK COIL	15 TURNS OF 1/2" X 1/16" COPPER STRAP WOUND EDGEWISE 5 5/8 OUTSIDE DIA. COMPLETE WITH PLUNGER, 20 MICROHENRIES			1			K-7810311 G1		0	0	0	L-1, S-1A, S-1B
X	X	X	L-2	M.O. FILAMENT CHOKE	TWO COAXIAL WINDINGS, BOTTOM WINDING 50 TURNS, TOP WINDING 48 1/2 TURNS, 3.5 AMPS. A.C. OR D.C.			1			P-7705707 G5		0	0	0	L-2
				M.O. FILAMENT CHOKE	SPARE FOR L-2			1			P-7705707 G1	1	1	1	1	
X	X	X	L-3	DOUBLER TANK COIL	16 5/6 TURNS OF #10 TINNED COPPER WIRE , 5 AMPS. R.F., 10 MICROHENRIES			1			P-7705659 G5		0	0	0	L-3
X	X	X	L-4	M.O. PLATE CHOKE COIL	INDUCTANCE 4 MILLIHENRIES D.C. RESISTANCE 10 OHMS			16	R-152		T-7607282 P197	1	1	1	1	L-4
X	X	X	L-5	1ST INT. AMP. PLATE CHOKE	125 TURNS INDUCTANCE 0.35 MILLIHENRY ±5%, D.C. RESISTANCE 1.35 OHMS, TEST INDUCTANCE AT 1000 CYCLES			1			L-303483	1	2 X	2 X	1 X	L-5, L-17, L-18 L-5, L-17, L-18 L-5
X	X	X	L-6	1ST INT. AMP. GRID CHOKE COIL	THREE SECTIONS, 20 TURNS EACH, 1/4" BETWEEN EACH SECTION, #26 S.C.C.E. WIRE, 200 M.A. D.C.			1			M-7405204 G2		0	0	0	L-6, L-8
				1ST INT. AMP. GRID CHOKE COIL	SPARE FOR L-6			1			M-7405204 G5	1	1	1	1	
X	X	X	L-7	1ST INT. AMP. TANK COIL	24 TURNS #14 TINNED COPPER SPACE WOUND, 5 AMPS. R.F.			1			P-7706592 G1		0	0	0	L-7
X	X	X	L-8	2ND INT. AMP. GRID CHOKE COIL	SAME AS L-6							1				

TABLE II (CONTINUED)

PARTS AND SPARE PARTS LIST BY SYMBOL DESIGNATION FOR MODEL TBM-11 RADIO TRANSMITTING EQUIPMENT

SUPPLY 115 V.D.C.	SUPPLY 230 V.D.C.	SUPPLY 440/3/60	SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY SPEC. OR DRAWING NUMBER	MFR.	MFR. DESIG.	SPECIAL TOL RATING OR MODIFICATION	CONTRACTOR'S DRAWING AND PART NUMBER	SPARE PARTS BOX NUMBER	SPARE PARTS QUANTITY 115 V.D.C.	SPARE PARTS QUANTITY 230 V.D.C.	SPARE PARTS QUANTITY 440/3/60	SPARE PARTS ALL SYMBOL DESIGNATIONS INVOLVED
					REACTORS (CLASS 30) AND INDUCTORS & CHOKES (CLASS 47) CONTINUED											
X	X	X	L-9	2ND INT. AMP. TANK COIL	ROTATING COIL, 22 MICROHENRIES 14 TURNS, 3/16" X 5/16" COPPER BAR WOUND EDGEWISE, 20 AMPS. R.F.			1			M-7409127 G2		0	0	0	L-9,S-20
X	X	X	L-10	2ND INT. AMP. PLATE CHOKE COIL	375 TURNS BASKET WOUND INDUCTANCE 4 MILLIHENRIES ±5%, D.C. RESISTANCE 5.15 OHMS, TEST INDUCTANCE AT 1000 CYCLE			1			L-303481	1	1	1	1	L-10,L-15
X	X	X	L-11	P.A. GRID CHOKE COIL	FOUR SECTIONS, 5-10-10-5 TURNS 1/4" BETWEEN SECTIONS, #30 D.C.C.CU. WIRE, 100 MILLIAMPS D.C.			1			M-7405204 G1		0	0	0	L-11
				P A. GRID CHOKE COIL	SPARE FOR L-11			1			M-7405204 G3	1	1	1	1	
X	X	X	L-12	P.A. GRID CHOKE COIL	65 TURNS OF #24 D.C.C.EN. WIRE INDUCTANCE 0.076 MILLIHENRY MIN., 0.092 MILLIHENRY MAX., RESISTANCE 0.62 OHM ±10%, TEST INDUCTANCE AT 1000 CYCLE			1			L-365782	1	1	1	1	L-12
X	X	X	L-13	ANTENNA TUNING COIL	ROTATING COIL, 22 MICROHENRIES, 14 TURNS, 3/16" X 5/16" COPPER BAR WOUND EDGEWISE, 20 AMPS. R.F.			1			M-7409127 G1		0	0	0	L-13
X	X	X	L-14	P.A. TANK COIL	ROTATING COIL, 22 MICROHENRIES, 14 TURNS, 3/16" X 5/16" COPPER BAR WOUND EDGEWISE, 20 AMPS. R.F.			1			M-7409127 G3		0	0	0	L-14,S-28
X	X	X	L-15	P.A. PLATE CHOKE COIL	SAME AS L-10							1				
X	X	X	L-16	THUMP FILTER CHOKE COIL	1600 TURNS, INDUCTANCE AT 110 V., 60 CYCLE AND 0.5 AMP. D.C., 1 HENRY MIN. D.C. RESISTANCE 40 OHMS MAX., 30 OHMS MIN., 60 CYCLE IMPEDANCE 377 OHMS MIN. TEST AT 1500 VOLTS A.C.	-30185		1	S#552144		P-7700950 G-1		0	0	0	L-16
X	X		L-17	BLOWER MOTOR FILTER CHOKE COIL	SAME AS L-5							1				
X	X		L-18	BLOWER MOTOR FILTER CHOKE COIL	SAME AS L-5							1				
X	X	X	L-19	P.A. GRID COIL	5 TURNS #10 TINNED COPPER WIRE, 7/8" INSIDE DIA.			1			M-7406169 G1		0	0	0	L-19
		X	L-20	RELAY REACTOR COIL	500 TURNS OF #21 ENAMELED WIRE, .18 HENRY AT 67.5 VOLTS A.C., 60 CYCLE D.C. RESISTANCE 3.3 OHMS ±15%, TEST 1500 VOLTS, 60 CYCLE			1			L-382514		0	0	0	L-20
X	X	X	L-401	MICROPHONE FILTER REACTOR	210 TURNS, INDUCTANCE 0.067 HENRY AT 4 VOLTS, 60 CYCLE, 0.66 AMP D.C., RESISTANCE 0.35 OHM D.C. ±15%, 60 CYCLE IMPEDANCE 25 OHMS, TEST 1500 VOLTS, 60 CYCLE	-30562		1			L-365747		0	0	0	L-401,L-406,L-407

TABLE II (CONTINUED)

PARTS AND SPARE PARTS LIST BY SYMBOL DESIGNATION FOR MODEL TBM-11 RADIO TRANSMITTING EQUIPMENT

SUPPLY 115 V.D.C.	SUPPLY 230 V.D.C.	SUPPLY 440/3/60	SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY SPEC. OR DRAWING NUMBER	MFR.	MFR. DESIG.	SPECIAL TOL RATING OR MODIFICATION	CONTRACTOR'S DRAWING AND PART NUMBER	SPARE PARTS BOX NUMBER	SPARE PARTS QUANTITY 115 V.D.C.	SPARE PARTS QUANTITY 230 V.D.C.	SPARE PARTS QUANTITY 440/3/60	SPARE PARTS ALL SYMBOL DESIGNATIONS INVOLVED
					REACTORS (CLASS 30) AND INDUCTORS & CHOKES (CLASS 47) CONTINUED											
X	X	X	L-402	VOICE RELAY FILTER REACTOR	4400 TURNS, INDUCTANCE 10 HENRIES AT 3 VOLTS, 60 CYCLE, 0.020 AMP. D.C., RESISTANCE 625 OHMS D.C. ±15% 60 CYCLE IMPEDANCE 3750 OHMS, TEST 1500 VOLTS, 60 CYCLE	-30566		1			L-365751		0	0	0	L-402
X	X	X	L-403	TONE OSCILLATOR CHOKE	2000 TURNS, INDUCTANCE 1.6 HENRIES AT 5 VOLTS, 1000 CYCLE, 0 AMPS. D.C. RESISTANCE 115 OHMS ±15%, 60 CYCLE IMPEDANCE 600 OHMS, TEST 1500 VOLTS 60 CYCLE	-30567		1			L-365752		0	0	0	L-403
X	X	X	L-404	MODULATION REACTOR	3000 TURNS, INDUCTANCE 35 HENRIES AT 110 VOLTS, 60 CYCLE, 0.27 AMP. D.C RESISTANCE 105 OHMS D.C. ±15%, 60 CYCLE IMPEDANCE 13200 OHMS, TEST 10000 VOLTS, 60 CYCLE	-30559		1			L-365743 OR L-420198		0	0	0	L-404
X	X	X	L-405	SCREEN GRID MODULATOR REACTOR	3600 TURNS, INDUCTANCE 30 HENRIES AT 100 VOLTS, 60 CYCLE, 0.070 AMP. D.C. RESISTANCE 180 OHMS D.C. ±15%, 60 CYCLE IMPEDANCE 11300 OHMS, TEST 1500 VOLTS, 60 CYCLE	-30568		1			L-365753		0	0	0	L-405
X	X	X	L-406	MICROPHONE FILTER REACTOR	SAME AS L-401	-30562							0	0	0	
X	X	X	L-407	MICROPHONE FILTER REACTOR	SAME AS L-401	-30562							0	0	0	
X	X	X	L-408	MODULATION GRID REACTOR	500 TURNS, INDUCTANCE 60 MILLIHENRIES AT 3 VOLTS, 60 CYCLE, 0.18 AMP. D.C., RESISTANCE 11 OHMS D.C. ±15%, 60 CYCLE IMPEDANCE 23 OHMS, TEST 1500 VOLTS, 60 CYCLE	-30569		1			L-365754		0	0	0	L-408
					ELECTRICAL INDICATING INSTRUMENTS (CLASS 22)											
X	X	X	M-1	ANTENNA CURRENT METER	AMMETER 0 TO 15 AMPS. R.F.	-22035	17-I-12	1	NT-35	WITH ANTI-GLARE GLASS	T-7605997 P15	1	1	1	1	M-1
X	X	X	M-2	P.A. PLATE CURRENT METER	MILLIAMMETER 0 TO 500 MILLIAMPS D.C.	-22067	17-I-12	1	NX-35	WITH ANTI-GLARE GLASS	T-7605997 P1	1	1	1	1	M-2
X	X	X	M-3	P.A. GRID CURRENT METER	MILLIAMMETER 0 TO 100 MILLIAMPS D.C.	-22059	17-I-12	1	NX-35	WITH ANTI-GLARE GLASS	T-7605997 P16	1	1	1	1	M-3,M-5,M-7
X	X	X	M-4	SECOND INTERMEDIATE AMP. PLATE CURRENT METER	MILLIAMMETER 0 TO 250 MILLIAMPS D.C.	-22065	17-I-12	1	NX-35	WITH ANTI-GLARE GLASS	T-7605997 P4	1	1	1	1	M-4,M-6,M-402,M-403 M-404
X	X	X	M-5	SECOND INT. AMP. GRID CURRENT METER	SAME AS M-3	-22059						1				
X	X	X	M-6	1ST INT. AMP. PLATE CURRENT METER	SAME AS M-4	-22065						1				

TABLE II (CONTINUED)

PARTS AND SPARE PARTS LIST BY SYMBOL DESIGNATION FOR MODEL TBM-11 RADIO TRANSMITTING EQUIPMENT

SUPPLY 115 V.D.C.	SUPPLY 230 V.D.C.	SUPPLY 440/3/60	SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY SPEC. OR DRAWING NUMBER	MFR.	MFR. DESIG.	SPECIAL TOL RATING OR MODIFICATION	CONTRACTOR'S DRAWING AND PART NUMBER	SPARE PARTS BOX NUMBER	SPARE PARTS QUANTITY 115 V.D.C.	SPARE PARTS QUANTITY 230 V.D.C.	SPARE PARTS QUANTITY 440/3/60	ALL SYMBOL DESIGNATIONS INVOLVED
				ELECTRICAL INDICATING INSTRUMENTS (CLASS 22) CONTINUED												
X	X	X	M-7	M.O. PLATE CURRENT METER	SAME AS M-3	-22059						1				
X	X	X	M-8	M.O. SCREEN CURRENT METER	MILLIAMMETER 0 TO 50 MILLIAMPS D.C.	-22056	17-I-12	1	NX-35	WITH ANTI-GLARE GLASS	T-7605997 P17	1	1	1	1	M-8
X	X	X	M-9	PLATE VOLTMETER	0 TO 3.5 KV. D.C., 1000 OHMS PER VOLT WITH EXTERNAL MULTIPLIER (M-9R, -63775)	-22311	17-I-12	1	NX-35	WITH ANTI-GLARE GLASS	T-7605997 P26	1	1	1	1	M-9
X	X	X	M-10	P.A. TUBE LIFE METER	100,000 HOUR TOTAL TIME METER FOR 120 VOLTS, 60 CYCLE OPERATION, LOWEST CALIBRATION 1/10 HOUR, CYCLOMETER TYPE	-22199C	17-I-12	-1	NH-35 S#1164055	WITH ANTI-GLARE GLASS	T-7605997 P27		0	0	0	M-10
X	X	X	M-11	FILAMENT VOLTMETER	0 TO 15 VOLTS A.C.	-22080	17-I-12	1	NA-35	WITH ANTI-GLARE GLASS	T-7605997 P6	1	1	1	1	M-11,M-406
X	X	X	M-12	BIAS VOLTMETER	0 TO 500 VOLTS D.C., 1000 OHMS PER VOLT (SELF CONTAINED MULTIPLIER)	-22225	17-I-12	1	NX-35	WITH ANTI-GLARE GLASS	T-7605997 P21	1	1	1	1	M-12
X	X	X	M-401	1ST AMP. PLATE METER	0 TO 30 MILLIAMPS D.C.	-22318	17-I-12	1	NX-35	WITH ANTI-GLARE GLASS	T-7605997 P19	5	1	1	1	M-401
X	X	X	M-402	2ND AMP. PLATE AMMETER	SAME AS M-4	-22065						1				
X	X	X	M-403	MODULATOR PLATE METER	SAME AS M-4	-22065						1				
X	X	X	M-404	MODULATOR PLATE METER	SAME AS M-4	-22065						1				
X	X	X	M-405	MODULATION METER	0 TO 100%, INCLUDES TRANSFORMER CAY-30557	-22229A	17-I-12	1	NQ-35	WITH ANTI-GLARE GLASS	T-7605997 P20	5	1	1	1	M-405
X	X	X	M-406	FILAMENT VOLTMETER	SAME AS M-11	-22080						1				
					MISCELLANEOUS (CLASS 10)											
		X	O-203	BALL BEARING	MARLIN ROCKWELL #308MF			1	S#1133077		33-J-185 P21	2	4	4	4	O-273
															X	O-203,O-223,O-241
														X		O-203,O-223
													X			O-223,O-241
																O-223,O-273
X	X	X	O-213	BALL BEARING	MARLIN ROCKWELL #305MF			1	S#1196895		33-J-176 P103	2	2	2	2	O-213
X	X	X	O-223	BALL BEARING	SAME AS O-203							2				
	X		O-241	BALL BEARING	SAME AS O-203							2				
X			O-273	BALL BEARING	SAME AS O-203							2				

TABLE II (CONTINUED)

PARTS AND SPARE PARTS LIST BY SYMBOL DESIGNATION FOR MODEL TBM-11 RADIO TRANSMITTING EQUIPMENT

SUPPLY 115 V.D.C.	SUPPLY 230 V.D.C.	SUPPLY 440/3/60	SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY SPEC. OR DRAWING NUMBER	MFR.	MFR. DESIG.	SPECIAL TOL RATING OR MODIFICATION	CONTRACTOR'S DRAWING AND PART NUMBER	SPARE PARTS BOX NUMBER	SPARE PARTS QUANTITY 115 V.D.C.	SPARE PARTS QUANTITY 230 V.D.C.	SPARE PARTS QUANTITY 440/3/60	ALL SYMBOL DESIGNATIONS INVOLVED
				RESISTORS, POTENTIOMETERS & RHEOSTATS (CLASS 63)												
X	X	X	R-1	BIAS POTENTIOMETER RESISTOR	10,000 OHMS, TAPPED 10 EQUAL VALUES STYLE B, GRADE 1, CLASS 2	-63484E	RE13A372J	17			T-7607283 P242	1	1	1	1	R-1
X	X	X	R-2	M.O. SCREEN RESISTOR	30,000 OHMS, STYLE A, GRADE 1	-63361E	RE13A372J	17			T-7607283 P243	1	1	1	1	R-2
X	X	X	R-3	M.O. PLATE RESISTOR	5000 OHMS, STYLE A, GRADE 1, CLASS 2	-63212E	RE13A372J	17			T-7607283 P244	1	1	1	1	R-3
X	X	X	R-4	KEYING RELAY ARC SUPPRESSOR RESISTOR	5000 OHMS, STYLE D, GRADE 1, CLASS 2	-63085E	RE13A372J	17			T-7607283 P245	1	1	1	1	R-4,R-17
			R-5	NOT USED												
X	X	X	R-6	FILAMENT RHEOSTAT	TWO 4" PLATES, 20 OHMS PER PLATE, EQUAL RESISTANCE STEPS, STAGGERED CONTACTS (SPECIAL)			17			P-7705853 P3		0	0	0	R-6
	X		R-7	BLOWER MOTOR SERIES RESISTOR	450 OHMS, STYLE D, GRADE 1, CLASS 2	-63069E	RE13A372J	17			T-7607283 P248	1	0	1	0	R-7
X	X	X	R-8	1ST INT. SCREEN RESISTOR	5000 OHMS, STYLE B, GRADE 1, CLASS 2	-63149E		17			T-7607283 P249	1	3	3	3	R-8,R-10,R-18,R-23, R-25
			R-9	NOT USED												
X	X	X	R-10	2ND INT. SCREEN RESISTOR	SAME AS R-8	-63149E						1				
X	X	X	R-11	LOW POWER FILAMENT RESISTOR	50 OHMS, TAPPED 10 EQUAL VALUES STYLE B, GRADE 1, CLASS 2	-63224E	RE13A372J	17			T-7607283 P252	1	1	1	1	R-11
X	X	X	R-12	P.A. SCREEN RESISTOR	1000 OHMS, STYLE B, GRADE 1, CLASS 2	-63141E	RE13A372J	17			T-7607283 P253	1	1	1	1	R-12
X	X	X	R-13	LOW VOLTAGE FIELD RESISTOR	1000 OHMS, TAPPED 10 EQUAL VALUES, STYLE B, GRADE 1, CLASS 2	-63257E	RE13A372J	17			T-7607283 P254	1	1	1	1	R-13
X	X	X	R-14	2ND INT. TANK CAP SHUNTING RESISTOR	1 MEG., 2 OHMS COMPOSITION	-63426	RE13A372G	18			T-7607283 P255	1	1	1	1	R-14,R-20
X	X	X	R-15	H.V. POTENTIOMETER RESISTOR	3000 OHMS, TAPPED 10 EQUAL VALUES STYLE A, GRADE 1, CLASS 2	-63236E	RE13A372J	17			T-7607283 P256	1	1	1	1	R-15
X	X	X	R-16	H.V. POTENTIOMETER RESISTOR	1500 OHMS, TAPPED 10 EQUAL VALUES STYLE A, GRADE 1, CLASS 2	-63233E	RE13A372J	17			T-7607283 P257	1	1	1	1	R-16
X	X	X	R-17	COMPENSATOR RELAY SERIES RESISTOR	SAME AS R-4	-63085E						1				
X	X	X	R-18	TUNING RESISTOR	SAME AS R-8							1				
X	X	X	R-19	BIAS POTENTIOMETER RESISTOR	500 OHMS, TAPPED 10 EQUAL VALUES STYLE B, GRADE 1, CLASS 2	-63227E	RE13A372J	17			T-7607283 P260	1	2	2	2	R-19,R-21,R-28
X	X	X	R-20	P.A. TANK CAP. SHUNTING RESISTOR	SAME AS R-14	-63426						1				

TABLE II (CONTINUED)

PARTS AND SPARE PARTS LIST BY SYMBOL DESIGNATION FOR MODEL TBM-11 RADIO TRANSMITTING EQUIPMENT

SUPPLY 115 V.D.C.	SUPPLY 230 V.D.C.	SUPPLY 440/3/60	SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY SPEC. OR DRAWING NUMBER	MFR.	MFR. DESIG.	SPECIAL TOL RATING OR MODIFICATION	CONTRACTOR'S DRAWING AND PART NUMBER	SPARE PARTS BOX NUMBER	SPARE PARTS QUANTITY 115 V.D.C.	SPARE PARTS QUANTITY 230 V.D.C.	SPARE PARTS QUANTITY 440/3/60	ALL SYMBOL DESIGNATIONS INVOLVED
				RESISTORS, POTENTIOMETERS & RHEOSTATS (CLASS 63)												
X	X	X	R-21	BIAS POTENTIOMETER RESISTOR	SAME AS R-19	-63227E						1				
X	X	X	R-22	P.A. GRID CHOKE SHUNTING RESISTOR	50,000 OHMS, STYLE D, GRADE 1, CLASS 2	-63097E	RE13A372J	17			T-7607283 P263	1	1	1	1	R-22
X	X	X	R-23	P.A. GRID RESISTOR	SAME AS R-8	-63149E						1				
X	X	X	R-24	2ND INT. GRID RESISTOR	20,000 OHMS, STYLE B, GRADE 1, CLASS 2	-63159E	RE13A372J	17			T-7607283 P265	1	1	1	1	R-24
X	X	X	R-25	1ST INT. GRID RESISTOR	SAME AS R-8	-63149E						1				
X	X	X	R-26	M.O. HEATER RESISTOR	2 SECTIONS, 118 OHMS PER SECTION			1			T-7604990 G7		0	0	0	R-26
		X	R-27	THERMOSTAT RELAY RESISTOR	2000 OHMS, STYLE D, GRADE 1, CLASS 2	-63554E	RE13A372J				T-7607283 P268	1	0	0	1	R-27
X	X	X	R-28	BIAS POTENTIOMETER RESISTOR	SAME AS R-19	-63227E						1				
X	X		R-29	KEYING POTENTIOMETER RESISTOR	600 OHMS, GRADE 1, CLASS 2	-63071E	RE13A372J	17			T-7607283 P270	1	0	1	0	R-29,R-32
X	X	X	R-30	KEYING CIRCUIT SERIES RESISTOR	400 OHMS, STYLE D, GRADE 1, CLASS 2	-63067E	RE13A372J	17			T-7607283 P271	1	1	1	1	R-30
			R-31	NOT USED												
	X		R-32	FIELD CONTACTOR SERIES RESISTOR	SAME AS R-29	-63071E						1				
X	X	X	R-33	GENERATOR FIELD RHEOSTAT RESISTOR	THREE 4" PLATES. STAGGERED CONTACTS RESISTANCE TO DECREASE WITH CLOCKWISE ROTATION			19			P-7707741 P1		0	0	0	R-33
	X		R-34	STARTING CONTACTOR SERIES RESISTOR.	1150 OHMS, STYLE D, GRADE 1, CLASS 2	-63733E	RE13A372J	19			T-7607283 P275	1	0	1	0	R-34
X			R-35	STARTING CONTACTOR SERIES RESISTOR	375 OHMS, STYLE D, GRADE 1, CLASS 2	-63732E	RE13A372J	19			T-7607283 P276	1	1	0	0	R-35
	X		R-36	KEYING POTENTIOMETER RESISTOR	1200 OHMS	-63077E		19			T-7607283 P277	1	0	1	0	R-36
			R-37 TO R-43	NOT USED												
		X	R-44	M.O. STANDBY COMPENSATOR RESISTOR	30 OHMS, STYLE D, GRADE 1, CLASS 2	-63051E	RE13A372J	19			T-7607283 P280	1	0	0	1	R-44
X	X	X	R-45	H.V. POTENTIOMETER RESISTOR	1500 OHMS, STYLE A, GRADE 1, CLASS 2	-63204E	RE13A372J	19			T-7607382 P281	1	2	2	2	R-45,R-46,R47,R-48
X	X	X	R-46	H.V. POTENTIOMETER RESISTOR	SAME AS R-45	-63204E						1				

TABLE II (CONTINUED)

PARTS AND SPARE PARTS LIST BY SYMBOL DESIGNATION FOR MODEL TBM-11 RADIO TRANSMITTING EQUIPMENT

SUPPLY 115 V.D.C.	SUPPLY 230 V.D.C.	SUPPLY 440/3/60	SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY SPEC. OR DRAWING NUMBER	MFR.	MFR. DESIG.	SPECIAL TOL RATING OR MODIFICATION	CONTRACTOR'S DRAWING AND PART NUMBER	SPARE PARTS BOX NUMBER	SPARE PARTS QUANTITY 115 V.D.C.	SPARE PARTS QUANTITY 230 V.D.C.	SPARE PARTS QUANTITY 440/3/60	ALL SYMBOL DESIGNATIONS INVOLVED
					RESISTORS, POTENTIOMETERS & RHEOSTATS (CLASS 63) CONTINUED											
X	X	X	R-47	H.V. POTENTIOMETER RESISTOR	SAME AS R-45	-63204E						1				
X	X	X	R-48	H.V. POTENTIOMETER RESISTOR	SAME AS R-45	-63204E						1				
	X	X	R-49	HEATER CONTROL RESISTOR	1 OHM, 3 WATT, CARBON	-63289	RE13A372G	20	TYPE D3-3		T-7607283 P285	1		1	1	R-49
X	X	X	R-50	THERMOSTAT SPARK SUPPRESSOR RESISTOR	30,000 OHMS, 1 WATT	-63288	RE13A372G	20	TYPE D1-1		T-7607283 P286	1	1	1	1	R-50
			R-51 TO R-55	NOT USED												
X			R-56	THERMOSTAT RELAY RESISTOR	2000 OHMS, STYLE D, GRADE 1, CLASS 2	-63553E	RE13A372J	19			T-7607284 P292	1	1	0	0	R-56
	X		R-57	THERMOSTAT RELAY RESISTOR	8000 OHMS, STYLE D, GRADE 1, CLASS 2	-63506E	RE13A372J				T-7607284 P293	1	0	1	0	R-57
X			R-58	HEATER CONTROL RESISTOR	3" OF #20 ENAM. NICHROME "V" RESISTANCE WIRE			1			T-7705763 G4	1	1	0	0	R-58
X	X	X	R-401	ATTENUATOR	600 OHMS. TOTAL ATTENUATION 30 D.B. IN 1.5 D.B. STEPS			2			T-7707250 P1	5	1	1	1	R-401
X	X	X	R-402	LOADING RESISTOR	120,000 OHMS, 1 WATT, COMPOSITION	-63288	RE13A372G	22			T-7606286 P60	5	1	1	1	R-402,R-403
X	X	X	R-403	LOADING RESISTOR	SAME AS R-402	-63288						5				
X	X	X	R-404	GRID RESISTOR	25,000 OHMS, 1 WATT, COMPOSITION	-63288	RE13A372G	22			T-7606286 P62	5	1	1	1	R-404
X	X	X	R-405	DIODE FILTER RESISTOR	50,000 OHMS, 1 WATT, COMPOSITION	-63288	RE13A372G	22			T-7606286 P63	5	1	1	1	R-405
X	X	X	R-406	DIODE LOADING RESISTOR	TWO MEGOHMS, 1 WATT, COMPOSITION	-63288	RE13A372G	22			T-7606286 P64	5	1	1	1	R-406
X	X	X	R-407	GRID LOADING RESISTOR	100,000 OHMS, 1 WATT, COMPOSITION	-63288	R-13A372G	22			T-7606286 P65	5	1	1	1	R-407,R-408
X	X	X	R-408	GRID LOADING RESISTOR	SAME AS R-407	-63288						5				
X	X	X	R-409	VOLUME CONTROL POTENTIOMETER	10,000 OHMS	-63844		22	TYPE CS		T-7606286 P67	5	1	1	1	R-409,R-432
X	X	X	R-410	MODULATOR GRID RESISTOR	1500 OHMS, 20 WATTS, GRADE 1, CLASS 2	-63545E	RE13A372J	17			T-7606286 P68	5	1	1	1	R-410,R-411
X	X	X	R-411	MODULATOR GRID RESISTOR	SAME AS R-410	-63545E						5				
X	X	X	R-412	VOICE RELAY GRID RESISTOR	5 MEGOHMS, 1 WATT, COMPOSITION	-63288	RE13A372G	22	BT-1		T-7606286 P70	5	1	1	1	R-412
X	X	X	R-413	VOICE RELAY RHEOSTAT	7000 OHMS, 50 WATTS			17			P-7707250 P6	5	1	1	1	R-413
X	X	X	R-414	BLEEDER RESISTOR	100 OHMS, 100 WATT, 10 TAPS, GRADE 1, CLASS 2	-63225E	RE13A372J	17			T-7606286 P72	5	1	1	1	R-414
X	X	X	R-415	FILAMENT RHEOSTAT	16 OHMS, 150 WATTS			17			P-7707250 P4		0	0	0	R-415

TABLE II (CONTINUED)

PARTS AND SPARE PARTS LIST BY SYMBOL DESIGNATION FOR MODEL TBM-11 RADIO TRANSMITTING EQUIPMENT

SUPPLY 115 V.D.C.	SUPPLY 230 V.D.C.	SUPPLY 440/3/60	SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY SPEC. OR DRAWING NUMBER	MFR.	MFR. DESIG.	SPECIAL TOL RATING OR MODIFICATION	CONTRACTOR'S DRAWING AND PART NUMBER	SPARE PARTS BOX NUMBER	SPARE PARTS QUANTITY 115 V.D.C.	SPARE PARTS QUANTITY 230 V.D.C.	SPARE PARTS QUANTITY 440/3/60	SPARE PARTS ALL SYMBOL DESIGNATIONS INVOLVED
					RESISTORS, POTENTIOMETERS & RHEOSTATS (CLASS 63) CONTINUED											
X	X	X	R-416	VOLTAGE REDUCTION RESISTOR	1250 OHMS, 200 WATTS, GRADE 1, CLASS 2	-63813E	RE13A372J	17			T-7605861 P38	5	1	1	1	R-416
X	X	X	R-417	MICROPHONE RESISTOR	150 OHMS, 10 WATTS, GRADE 1, CLASS 2	-63814E	RE13A372J	17			T-7605861 P41	5	1	1	1	R-417,R427
X	X	X	R-418	SCREEN GRID RESISTOR	10,000 OHMS, 1 WATT, COMPOSITION	-63288	RE13A372G	22			T-7606287 P76	5	1	1	1	R-418,R-425
X	X	X	R-419	BLEEDER RESISTOR	SAME AS R-13	-63257E						5	1	1	1	R-419,R-420,R-421
X	X	X	R-420	BLEEDER RESISTOR	SAME AS R-13	-63257E						5				
X	X	X	R-421	BLEEDER RESISTOR	SAME AS R-13	-63257E						5				
X	X	X	R-422	SURGE RESISTOR	100 OHMS, 100 WATTS, GRADE 1, CLASS 2	-63124E	RE13A372J	17			T-7606287 P80	5	1	1	1	R-422
			R-423	NOT USED												
			R-424	NOT USED												
X	X	X	R-425	STABILIZING RESISTOR	SAME AS R-418	-63288						5				
X	X	X	R-426	VOICE RELAY FIXED RESISTOR	3000 OHMS, 1 WATT, COMPOSITION	-63288	RE13A372G	22	BT-1		T-7606287 P84	5	1	1	1	R-426
X	X	X	R-427	BLEEDER RESISTOR	SAME AS R-417	-63814E						5				
			R-428	NOT USED												
X	X	X	R-429	ATTENUATOR	600 OHMS, TOTAL TAPERED RANGE FROM 1 1/2 D.B. TO 128 D.B. ON LAST CONTACT			21			T-7606287 P87	5	1	1	1	R-429
			R-430	NOT USED												
			R-431	NOT USED												
X	X	X	R-432	A.V.C. POTENTIOMETER	SAME AS R-409	-63844						5				
X	X	X	R-433	O.L. RELAY SHUNT RESISTOR	25 OHMS, 10 WATTS, GRADE 1, CLASS 2	-63349E	RE13A372J	17			T-7606287 P92	5	1	1	1	R-433
			R-434	NOT USED												
X	X	X	R-435	INDICATOR LIGHT SERIES RESISTOR	1500 OHMS, 60 WATTS, GRADE 1, CLASS 1	-63078F	RE13A372J	23			T-7606287 P81	5	1	1	1	R-435,R-436
X	X	X	R-436	INDICATOR LIGHT SERIES RESISTOR	SAME AS R-435	-63078F						5				
X			R-841	STARTING RESISTOR	.84 OHMS			1	S#1308647		45-J-406 P9	2	1	0	0	R-841
X			R-842	POTENTIOMETER RESISTOR	400 OHMS			1	S#884241		45-J-406 P8	2	1 X	1 X	0	R-842,R-852 R-842 R-852

TABLE II (CONTINUED)

PARTS AND SPARE PARTS LIST BY SYMBOL DESIGNATION FOR MODEL TBM-11 RADIO TRANSMITTING EQUIPMENT

SUPPLY 115 V.D.C.	SUPPLY 230 V.D.C.	SUPPLY 440/3/60	SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY SPEC. OR DRAWING NUMBER	MFR.	MFR. DESIG.	SPECIAL TOL RATING OR MODIFICATION	CONTRACTOR'S DRAWING AND PART NUMBER	SPARE PARTS BOX NUMBER	SPARE PARTS QUANTITY 115 V.D.C.	SPARE PARTS QUANTITY 230 V.D.C.	SPARE PARTS QUANTITY 440/3/60	ALL SYMBOL DESIGNATIONS INVOLVED
					RESISTORS, POTENTIOMETERS & RHEOSTATS (CLASS 63) CONTINUED											
	X		R-851	STARTING RESISTOR	3 OHMS			1	S#1312911		45-J-408 P9	2	0	1	0	R-851
	X		R-852	POTENTIOMETER RESISTOR	SAME AS R-842							2				
					RECTOX (CLASS 20)											
X	X	X	RX-401	MICROPHONE SUPPLY RECTOX	1.35 MAX. AMPS., 12.8 VOLTS. APPLY 1 COAT OF VARNISH AND CADMIUM PLATE ALL CONDENSERS FOR NAVAL SERVICE			1	S#1186496		P-7707252 P2		0	0	0	RX-401
X	X	X	RX-402	SURGE LIMITING RECTOX	0.1 MAX. AMPS., 18 MAX. VOLTS. APPLY 2 COATS OF VARNISH, TERMINALS TO BE PLATED WITH TIN, CADMIUM OR NICKEL			1	S#1190435		T-7606287 P134		0	0	0	RX-402,RX-403
X	X	X	RX-403	SURGE LIMITING RECTOX	SAME AS R-402								0	0	0	
					SWITCHES (CLASS 24) AND THERMOSTATS (CLASS 40)											
X	X	X	S-1A	M.O. RANGE SWITCH	PART OF L-1								0	0	0	
X	X	X	S-1B	M.O. RANGE SWITCH	PART OF L-1								0	0	0	
X	X	X	S-1C	M.O. RANGE INTERLOCK SWITCH	PART OF M.O. DIAL ASSEMBLY								0	0	0	
X	X	X	S-2A	P.A. RANGE INTERLOCK SWITCH	INTERLOCK SWITCH			1			P-7705078 G2		0	0	0	S-2A
X	X	X	S-2B	P.A. RANGE SWITCH	PART OF L-14								0	0	0	
X	X	X	S-2C	P.A. RANGE (GRID) SWITCH	S.P.S.T., ONE BREAK PER CIRCUIT KNIFE SWITCH TYPE			1			M-7406186 G5		0	0	0	S-2C
X	X	X	S-2D	2ND INT. RANGE SWITCH	PART OF L-9								0	0	0	
X	X	X	S-2E	1ST INT. RANGE SWITCH	S.P.S.T., ONE BREAK PER CIRCUIT, KNIFE SWITCH TYPE			1			T-7605006 G2		0	0	0	S-2E
X	X	X	S-3A	FILAMENT COMPENSATION SWITCH	10 AMPS., 125 VOLTS, TOGGLE TYPE	-24095A		28			P-7706780 P1	1	1	1	1	S-3A;S-3B,S-3C, S-27
X	X	X	S-3B	P.A. FILAMENT SWITCH	SAME AS S-3A	-24095A						1				
X	X	X	S-3C	TUBE LIFE METER SWITCH	SAME AS S-3A	-24095A						1				
X	X	X	S-4A	P.A. GRID (HI-LO POWER) SWITCH	2 P.D.T.			1			P-7704417 G1		0	0	0	S-4A,S-4B
X	X	X	S-4B	I.A. TRANSFER (HI-LO POWER) SWITCH	PART OF S-4A								0	0	0	

TABLE II (CONTINUED)

PARTS AND SPARE PARTS LIST BY SYMBOL DESIGNATION FOR MODEL TBM-11 RADIO TRANSMITTING EQUIPMENT

SUPPLY 115 V.D.C.	SUPPLY 230 V.D.C.	SUPPLY 440/3/60	SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY SPEC. OR DRAWING NUMBER	MFR.	MFR. DESIG.	SPECIAL TOL RATING OR MODIFICATION	CONTRACTOR'S DRAWING AND PART NUMBER	SPARE PARTS BOX NUMBER	SPARE PARTS QUANTITY 115 V.D.C.	SPARE PARTS QUANTITY 230 V.D.C.	SPARE PARTS QUANTITY 440/3/60	ALL SYMBOL DESIGNATIONS INVOLVED
					SWITCHES (CLASS 24) AND THERMOSTATS (CLASS 40) CONTINUED											
X	X	X	S-5A	ANTENNA TRANSFER (HI-LO POWER) SWITCH	3 P.D.T., ONE BREAK PER CIRCUIT, 10 AMPS. R.F. D.C., 3000 VOLTS, ROTARY TYPE			1			T-7603470 G2		0	0	0	S-5A,S-5B,S-5C
X	X	X	S-5B	P.A. SCREEN GRID (HI-LO POWER) SWITCH	PART OF S-5A								0	0	0	
X	X	X	S-5C	P.A. PLATE (HI-LO POWER) SWITCH	PART OF S-5A								0	0	0	
X	X	X	S-6	ANTENNA CURRENT VOLTAGE FEED SWITCH	D.P.D.T. ONE BREAK PER CIRCUIT, 20 A. R.F., 3000 VOLTS, ROTARY TYPE			1			T-7603486 G4		0	0	0	S-6
X	X	X	S-7	LOCAL REMOTE SWITCH	4 P.D.T. ONE BREAK PER CIRCUIT, 2 A. 250 VOLTS, TOGGLE TYPE	-24086		24			P-7707082 P2		0	0	0	S-7,S-403
X	X	X	S-8	4 WIRE START STOP SWITCH	D.P.S.T., 10 AMPS. AT 250 V.A.C., PUSH BUTTON TYPE			1			P-7707242 G4		0	0	0	S-8
				4 WIRE START STOP SWITCH	SPARE FOR S-8			1			P-7707242 G10	1	1	1	1	
X	X	X	S-9	(ADJ. TUNE OPERATE) SWITCH	D.P., TRIPLE THROW, ONE BREAK EACH IN TWO CIRCUITS, 3 A., 3000 VOLTS D.C., ROTARY TYPE, INTERLOCK SAME AS S-1C			1			T-7604978 G6		0	0	0	S-9,S-9A
X	X	X	S-9A	INTERLOCK SWITCH	PART OF S-9								0	0	0	
X	X	X	S-10	TEST KEY SWITCH	D.P.D.T., OPEN NEUTRAL LOCK AND NON-LOCK, 10 AMPS. A.C., 2 AMPS. D.C. AT 110 VOLTS, TOGGLE TYPE	-24069A		24			P-7707082 P1		0	0	0	S-10
X	X	X	S-11	TEMPERATURE PROTECTION SWITCH	S.P.S.T., 2 BREAKS PER CIRCUIT, SPENCER DISC OPEN 68°-71°C. CLOSED 55°C-60°C., 3.0 AMPS. AT 330 VOLTS D.C. OR 2.5 A. AT 220 VOLTS, 60 CYCLE	-40034		1			M-7406282 P1	1	1	1	1	S-11
X	X	X	S-12	EMERGENCY STOP SWITCH	D.P.S.T., 2 BREAKS PER CIRCUIT, 30 AMPS., 250 VOLTS, TUMBLER TYPE	-24072		1			P-7706780 P2	1	1	1	1	S-12
X	X	X	S-13	THERMOSTAT SWITCH	SINGLE CIRCUIT, DOUBLE BREAK 60°C PLATNIMUM CONTACTS SET WITHIN 0.05°C ANGLE TYPE	-40010	RE13A486C	25			T-7603330 P32	1	2	2	2	S-13
X	X	X	S-14	DOOR INTERLOCK SWITCH	SINGLE CIRCUIT, DOUBLE BREAK, 1 AMP. 500 VOLTS, INTERLOCK TYPE	-24067		1	S#867378		T-7607284 P324	1	2	2	2	S-14,S-15,S-16
X	X	X	S-15	DOOR INTERLOCK SWITCH	SAME AS S-14	-24067						1				
X	X	X	S-16	DOOR INTERLOCK SWITCH	SAME AS S-14	-24067						1				
X	X	X	S-17	6 WIRE START STOP SWITCH	2 BUTTON, MOMENTARY, 10 AMPS., 250 V. A.C., PUSH BUTTON TYPE			1			P-7707242 G3		0	0	0	S-17
				6 WIRE START STOP SWITCH	SPARE FOR S-17			1			P-7707242 G9	1	1	1	1	

TABLE II (CONTINUED)

PARTS AND SPARE PARTS LIST BY SYMBOL DESIGNATION FOR MODEL TBM-11 RADIO TRANSMITTING EQUIPMENT

SUPPLY 115 V.D.C.	SUPPLY 230 V.D.C.	SUPPLY 440/3/60	SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY SPEC. OR DRAWING NUMBER	MFR.	MFR. DESIG.	SPECIAL TOL RATING OR MODIFICATION	CONTRACTOR'S DRAWING AND PART NUMBER	SPARE PARTS BOX NUMBER	SPARE PARTS QUANTITY 115 V.D.C.	SPARE PARTS QUANTITY 230 V.D.C.	SPARE PARTS QUANTITY 440/3/60	ALL SYMBOL DESIGNATIONS INVOLVED
					SWITCHES (CLASS 24) AND THERMOSTATS (CLASS 40) CONTINUED											
X	X	X	S-18	CONTROL LINK SWITCH	CONTACTOR PANEL ASSEMBLY			1			T-7607284 P331		0	0	0	S-18
		X	S-19	CONTROL LINK SWITCH	CONTACTOR PANEL ASSEMBLY			1			T-7607284 P332		0	0	0	S-19
			S-20	NOT USED												
X	X		S-21	CONTROL LINK SWITCH	CONTROL PANEL ASSEMBLY			1			T-7607284 P334		0	0	0	S-21
			S-22 TO S-26	NOT USED												
		X	S-27	M.O. FILAMENT STANDBY SWITCH	SAME AS S-3A	-24095A						1				
X	X	X	S-401	MICROPHONE HOOK SWITCH	4 P.D.T., ONE BREAK PER CIRCUIT			26			M-7407454 P1		0	0	0	S-401
X	X	X	S-402	AUTOMATIC MANUAL SWITCH	S.P.D.T., ONE BREAK PER CIRCUIT, THREE WAY, TOGGLE TYPE			27	3953 BLA		M-7407457 P1	5	1	1	1	S-402
X	X	X	S-403	CARRIER CONTROL SELECTOR SWITCH	SAME AS S-7	-24086							0	0	0	
X	X	X	S-404	TALK SWITCH	LOCKING & NON-LOCKING	-24085		24			P-7707082 P3		0	0	0	S-404
X	X	X	S-405	CW-MCW VOICE SWITCH	MULTI CONTACT, THREE POSITIONS, TWO BREAKS PER CIRCUIT, ROTARY TYPE			1			T-7607518 G1		0	0	0	S-405
X	X	X	S-406	DOOR INTERLOCK	SAME AS S-14	-24067						5	1	1	1	S-406,S-407
X	X	X	S-407	DOOR INTERLOCK	SAME AS S-14	-24067						5				
X	X	X	S-408	LINK SWITCH	PART OF ASSEMBLY											
X	X	X	S-409	LINK SWITCH	PART OF ASSEMBLY											
X	X	X	S-410	LINK SWITCH	PART OF ASSEMBLY											
					TRANSFORMER (CLASS 30)											
X	X	X	T-1	FILAMENT TRANSFORMER	0.21 KVA., 60 CYCLE WDG. TAPS VOLTS AMPS TURNS OHMS P1 4TO6 100 1.18 113 1.2 P1 5TO6 70 1.70 79 1.0 P2 1TO3 100 1.18 113 1.2 P2 1TO2 70 1.70 79 1.0 S1 7TO8 6.7 10 7 .018 S1 7TO9 11.4 10 13.5 .032 S2 13TO14 5 6.5 6 .025 S2 13TO15 10 6.5 12 .05 S3 10TO11 5.5 3.25 6.5 .04 S3 10TO12 11 3.25 13 .08 TEST 2500 VOLTS	-30302		1			L-317196		0	0	0	T-1

TABLE II (CONTINUED)

PARTS AND SPARE PARTS LIST BY SYMBOL DESIGNATION FOR MODEL TBM-11 RADIO TRANSMITTING EQUIPMENT

SUPPLY 115 V.D.C.	SUPPLY 230 V.D.C.	SUPPLY 440/3/60	SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY SPEC. OR DRAWING NUMBER	MFR.	MFR. DESIG.	SPECIAL TOL RATING OR MODIFICATION	CONTRACTOR'S DRAWING AND PART NUMBER	SPARE PARTS BOX NUMBER	SPARE PARTS QUANTITY 115 V.D.C.	SPARE PARTS QUANTITY 230 V.D.C.	SPARE PARTS QUANTITY 440/3/60	ALL SYMBOL DESIGNATIONS INVOLVED
					TRANSFORMERS (CLASS 30) CONTINUED											
			T-2	NOT USED												
X	X	X	T-3	COMPENSATOR TRANSFORMER	1.2 WATTS, 60 CYCLE PRIMARY - 100 V., .012 AMP., 4180 TURNS, 600 OHMS SECONDARY - 0.125 V., 10 AMPS., 10 TURNS, .009 OHMS TEST 1500 VOLTS			1			L-332701		0	0	0	T-3
			T-4 TO T-11	NOT USED												
		X	T-12	AUX. M.O. FIL. TRANSFORMER	0.36 KVA., 60 CYCLE WDG. TAPS VOLTS TURNS OHMS S1 5TO7 11 68 .085 P1 1TO2 100 580 16.5 P2 3TO4 100 580 16.5 TEST 1500 VOLTS	-30303		1			L-332702		0	0	0	T-12
			T-13	NOT USED												
		X	T-14	STEP DOWN TRANSFORMER	0.335 KVA., 60 CYCLE WDG. TAPS VOLTS TURNS OHMS P1 1TO2 440 240 4.8 P2 3TO4 220 240 4.8 S1 5TO6 220 125 1.325 S2 7TO8 110 125 1.325	-30301		1			L-317195		0	0	0	T-14
		X	T-15	STEP DOWN TRANSFORMER	0.25 KVA., 60 CYCLE WDG. TAPS VOLTS TURNS OHMS P1 1TO2 440 320 9.25 P2 3TO4 220 320 9.25 S1 5TO6 220 168 1.5 S2 7TO8 110 168 1.5	-30300		1			L-317194		0	0	0	T-15
X	X	X	T-401	MICROPHONE TRANSFORMER	100 TO 5000 CYCLE WDG. TAPS VOLTS TURNS OHMS PRI. 1TO2 1.0 400 5.0 SEC. 3TO4 3.2 1280 62 TEST 1200 VOLTS	-30563		1			L-365748		0	0	0	T-401
X	X	X	T-402	LINE INPUT TRANSFORMER	100 TO 5000 CYCLE WDG. TAPS VOLTS TURNS OHMS P1 5TO6 0.31 250 10 4TO6 0.19 150 7 S1 1TO2 5. 4000 1330 S2 2TO3 5. 4000 2000 TEST 1500 VOLTS	-30565		1			L-365750		0	0	0	T-402

TABLE II (CONTINUED)

PARTS AND SPARE PARTS LIST BY SYMBOL DESIGNATION FOR MODEL TBM-11 RADIO TRANSMITTING EQUIPMENT

SUPPLY 115 V.D.C.	SUPPLY 230 V.D.C.	SUPPLY 440/3/60	SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY SPEC. OR DRAWING NUMBER	MFR.	MFR. DESIG.	SPECIAL TOL RATING OR MODIFICATION	CONTRACTOR'S DRAWING AND PART NUMBER	SPARE PARTS BOX NUMBER	SPARE PARTS QUANTITY 115 V.D.C.	SPARE PARTS QUANTITY 230 V.D.C.	SPARE PARTS QUANTITY 440/3/60	ALL SYMBOL DESIGNATIONS INVOLVED
				TRANSFORMERS (CLASS 30) CONTINUED												
X	X	X	T-403	INTERSTAGE TRANSFORMER	100 TO 5000 CYCLE WDG. TAPS VOLTS TURNS OHMS P1 1T02 9 2000 1350 P2 2T03 9 2000 1350 S1 & S2 7T08 5.5 1160 105 S3 5T06 14 3000 2500 S4 4T05 14 3000 2500 TEST 1500 VOLTS	-30564		1			L-365749		0	0	0	T-403
X	X	X	T-404	DRIVER TRANSFORMER	10 V.A., 100 TO 5000 CYCLE WDG. TAPS VOLTS TURNS OHMS P1 1T02 127 750 50.5 P2 2T03 127 750 50.5 S1 9T010 63 375 25.3 10T011 64 375 25.3 S2 6T07 38 220 15.0 7T08 37 220 14.8 S3 4T05 10 60 4.1 TEST 1500 VOLTS	-30560		1			L-365744		0	0	0	T-404
X	X	X	T-405	MODULATION TRANSFORMER	400 V.A., 100 TO 5000 CYCLE WDG TAPS VOLTS AMPS TURNS OHMS P1 & P2 1T02 1130 0.35 800 40 P2 & P3 3T04 1130 0.35 800 50 S1 & S2 5T06 243 0.21 181 10 S1 & S2 6T07 28 0.21 21 1 S1 & S2 7T08 1640 0.21 1218 69 TEST 6000 VOLTS	-30558		1			L-365742 OR L-420197		0	0	0	T-405
X	X	X	T-406	MODULATION METER TRANSFORMER	100 TO 5000 CYCLE WDG. TAPS AMPS. TURNS OHMS PRI 1T02 0.21 120 1.2 S1 3T02 0.0045 2800 1450 S2 2T04 0.0045 2800 2000 INDUCTANCE 22 MA MAX.	-30557		1			L-365741		0	0	0	T-406
X	X	X	T-407	VOICE RELAY TRANSFORMER	RATIO 10 TO 1, 100 TO 3000 CYCLE WDG. TAPS VOLTS TURNS OHMS P1 1T02 5 900 35 S1 3T04 50 9150 3750 TEST 1500 VOLTS	-30570		1			L-365779		0	0	0	T-407

TABLE II (CONTINUED)

PARTS AND SPARE PARTS LIST BY SYMBOL DESIGNATION FOR MODEL TBM-11 RADIO TRANSMITTING EQUIPMENT

SUPPLY 115 V.D.C.	SUPPLY 230 V.D.C.	SUPPLY 440/3/60	SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY SPEC. OR DRAWING NUMBER	MFR.	MFR. DESIG.	SPECIAL TOL RATING OR MODIFICATION	CONTRACTOR'S DRAWING AND PART NUMBER	SPARE PARTS BOX NUMBER	SPARE PARTS QUANTITY 115 V.D.C.	SPARE PARTS QUANTITY 230 V.D.C.	SPARE PARTS QUANTITY 440/3/60	ALL SYMBOL DESIGNATIONS INVOLVED
					TRANSFORMERS (CLASS 30) CONTINUED											
X	X	X	T-408	FILAMENT TRANSFORMER	172 V.A., 60 CYCLE WDG. TAPS VOLTS AMPS TURNS OHMS P1 4T05 30 1.0 33 0.6 5T06 70 1.0 79 1.4 P2 1T02 70 1.0 78 1.6 2T03 30 1.0 34 0.8 S1 7T08 1 1.2 1 0.01 8T09 18 1.2 18.5 0.18 9T010 2.5 1.2 2.5 0.02 10T011 2 1.2 2 0.02 S2 13T014 6.5 10 7.5 0.015 14T015 4 10 4.5 0.009 13T023 5.2 10 6 0.012 S3 20T021 1.2 5 1 0.008 21T022 1.35 5 2 0.009 S4 17T018 3.2 3.3 4.0 0.022 18T019 3.2 3.3 3.5 0.026 S5 12T016 25 0.3 29 0.55 TEST 2000 VOLTS	-30561		1			L-365745		0	0	0	T-408
X	X	X	T-409	POWER TRANSFORMER	375 V.A., 60 CYCLE WDG. TAPS VOLTS AMPS. TURNS OHMS P1 1T02 220 0.85 240 3.6 P2 3T04 220 0.85 240 6 S1 5T06 110 1.7 125 1.0 S2 7T08 110 1.7 125 1.65 TEST 2000 VOLTS	-30495		1			L-365737 OR R-1421		0	0	0	T-409
					THERMOMETERS (CLASS 40)											
X	X	X	TH-1	M.O. TEMPERATURE THERMOMETER	CALIBRATED 30°C TO 70°C, STEM 7" X 1/4", ANGLE TYPE	-40025	RE13A486C	29			T-7603258 P28	1	2	2	2	TH-1
					VACUUM TUBES (CLASS 38)											
X	X	X	VT-1	R.F. OSCILLATOR VACUUM TUBE	(TRANSMITTING TETRODE) R.F. SCREEN GRID OSCILLATOR OR POWER AMPLIFIER, GLASS BASE: MEDIUM FOUR PIN BAYONET, CERAMIC GRID AND PLATE LEADS ARE SEPARATE LEADS THROUGH GLASS BULB HEATER CURRENT 3.25 AMPS. AT 10 VOLTS A.C. OR D.C. PLATE DISSIPATION 100 WATTS	-860	RE13A600A	30	WL-860		DL-7502199 L7	*	3	3	3	VT-1,VT-2,VT-3
X	X	X	VT-2	R.F. 1ST INT. POWER AMP. VACUUM TUBE	SAME AS VT-1	-860						*				
X	X	X	VT-3	R.F. 2ND INT. POWER AMP. VACUUM TUBE	SAME AS VT-1	-860						*				

*TUBES PACKED IN INDIVIDUAL CARTONS

TABLE II (CONTINUED)

PARTS AND SPARE PARTS LIST BY SYMBOL DESIGNATION FOR MODEL TBM-11 RADIO TRANSMITTING EQUIPMENT

SUPPLY 115 V.D.C.	SUPPLY 230 V.D.C.	SUPPLY 440/3/60	SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY SPEC. OR DRAWING NUMBER	MFR.	MFR. DESIG.	SPECIAL TOL RATING OR MODIFICATION	CONTRACTOR'S DRAWING AND PART NUMBER	SPARE PARTS BOX NUMBER	SPARE PARTS QUANTITY 115 V.D.C.	SPARE PARTS QUANTITY 230 V.D.C.	SPARE PARTS QUANTITY 440/3/60	ALL SYMBOL DESIGNATIONS INVOLVED
				VACUUM TUBES (CLASS 38) CONTINUED												
X	X	X	VT-4	R.F. POWER AMP. VACUUM TUBE	R.F. SCREEN GRID POWER AMP. GLASS BASE: SPECIAL TWO PIN BAYONET AND ONE BAR CONTACT CERAMIC SCREEN GRID AND PLATE. SPECIAL CAPS, CURRENT LEAD THROUGH SIDE OF GLASS BULB. HEATER CURRENT 10 AMPS. AT 11 VOLTS A.C. OR D.C. PLATE DISSIPATION 400 WATTS	-861	RE13A600A	30	WL-861		DL-7502199 L6	*	1	1	1	VT-4
			VT-5	NOT USED												
X	X	X	VT-401	AUDIO FREQUENCY AMPLIFIER VACUUM TUBE	(TRIPLE GRID AMP.) AUDIO FREQUENCY TRIPLE CURRENT SUPER CONTROL AMP. BASE: SMALL SIX PIN BAYONET TYPE, PHENOLIC, SMALL METAL CAP. HEATER CURRENT 0.3 AMPS. AT 6.3 VOLTS	-6D6		31			DL-7502199 L1	*	2	2	2	VT-401,VT-402
X	X	X	VT-402	AUDIO FREQUENCY AMPLIFIER VACUUM TUBE	SAME AS VT-401	-6D6						*				
X	X	X	VT-403	AUDIO FREQUENCY AMPLIFIER	KEYER PENTODE, GLASS BASE: MEDIUM 5 PIN BAYONET, SMALL METAL CAP, HEATER CURRENT 0.9 AMPS. 6.3 VOLTS A.C. OR D.C., PLATE DISSIPATION 25 WATTS	-807		30	WL-807		DL-7502199 L2	*	3	3	3	VT-403,VT-404 VT-408
X	X	X	VT-404	AUDIO FREQ. AMPLIFIER VACUUM TUBE	SAME AS VT-403	-807						*				
X	X	X	VT-405	AUDIO FREQ. AMPLIFIER VACUUM TUBE	R.F. POWER AMPLIFIER PENTODE, GLASS BASE: GIANT 5 PIN BAYONET PHENOLIC, MEDIUM METAL CAP, FILAMENT CURRENT 5 AMPS. AT 10 VOLTS A.C. OR D.C. PLATE DISSIPATION 125 WATTS	-803		30			DL-7502199 L3	*	2	2	2	VT-405,VT-406
X	X	X	VT-406	AUDIO FREQ. AMPLIFIER VACUUM TUBE	SAME AS VT-405	-803						*				
X	X	X	VT-407	PEAK VOLTAGE LIMITER VACUUM TUBE	(RECTIFIER-HIGH VACUUM) HALF WAVE RECTIFIER GLASS, BASE: MEDIUM 4 PIN BAYONET, PHENOLIC, MEDIUM METAL CAP. HEATER CURRENT 5 AMPS. AT 2.5 VOLTS A.C.	-1616		31			DL-7502199 L4	*	1	1	1	VT-407
X	X	X	VT-408	AUDIO AMPLIFIER VACUUM TUBE	SAME AS VT-403	-807						*				
X	X	X	VT-409	VOLUME CONTROL VACUUM TUBE	(HIGH VACUUM RECTIFIER) BASE: SMALL SIX PIN BAYONET PHENOLIC. HEATER CURRENT 0.3 AMPS AT 25 VOLTS A.C. OR D.C.	-25Z5		31			DL-7502199 L5	*	1	1	1	VT-409

*TUBES PACKED IN INDIVIDUAL CARTONS

TABLE II (CONTINUED)

PARTS AND SPARE PARTS LIST BY SYMBOL DESIGNATION FOR MODEL TBM-11 RADIO TRANSMITTING EQUIPMENT

SUPPLY 115 V.D.C.	SUPPLY 230 V.D.C.	SUPPLY 440/3/60	SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY SPEC. OR DRAWING NUMBER	MFR.	MFR. DESIG.	SPECIAL TOL RATING OR MODIFICATION	CONTRACTOR'S DRAWING AND PART NUMBER	SPARE PARTS BOX NUMBER	SPARE PARTS QUANTITY 115 V.D.C.	SPARE PARTS QUANTITY 230 V.D.C.	SPARE PARTS QUANTITY 440/3/60	ALL SYMBOL DESIGNATIONS INVOLVED
					FLEXIBLE LEADS (CLASS 62)											
			W-1	FLEXIBLE CONNECTOR LEAD				1			K-7807095 G1	1	1	1	1	W-1
			W-2	FLEXIBLE LEAD	LENZ AEROGLAS 5000 VOLTS #12 STRANDED 65 OF .010 WHITE WITH GREEN TRACER RADIO HOOK-UP WIRE			32			T-7607285 P375	1	1	1	1	W-2
				TERMINAL	FOR SPARES ONLY			1	S#867471		T-7607285 P385	1	1	1	1	
				TERMINAL	FOR SPARES ONLY			1	S#867295A		T-7607285 P382	1	30	30	30	
				TERMINAL	FOR SPARES ONLY			1	S#867475		T-7607285 P383	1	10	10	10	
				TERMINAL	FOR SPARES ONLY			1	S#867474		T-7607285 P384	1	10	10	10	
				WIRES & TERMINALS	FOR SPARES ONLY			1			P-7707240 G2	5	1	1	1	
					VACUUM TUBE SOCKETS (CLASS 49)											
X	X	X	X-1	M.O. TUBE SOCKET	7-1/2 WATTS, 4 CONTACTS, BAYONET TYPE	-49309					T-7605251 P16		0	0	0	X-1,X-2,X-3
X	X	X	X-2	1ST INT AMP. TUBE SOCKET	SAME AS X-1	-49309							0	0	0	
X	X	X	X-3	2ND INT AMP. TUBE SOCKET	SAME AS X-1	-49309							0	0	0	
X	X	X	X-4	POWER AMP. TUBE SOCKET	FILAMENT FOR TUBE TYPE -38161	-49316A		1			P-7705850 G2		0	0	0	X-4
X	X	X	X-5	POWER AMP. TUBE SOCKET	PLATE FOR TUBE TYPE -38161	-49315A		1			P-7705850 G1		0	0	0	X-5
			X-6	NOT USED												
X	X	X	X-401	SOCKET	6 PRONG, ISOLANTITE			4	TYPE S6		P-7706776 P8		0	0	0	X-401,X-402,X-409
X	X	X	X-402	SOCKET	SAME AS X-401								0	0	0	
X	X	X	X-403	SOCKET	5 PRONG, ISOLANTITE			4	TYPE S5		P-7706776 P7		0	0	0	X-403,X-404,X-408
X	X	X	X-404	SOCKET	SAME AS X-403								0	0	0	
X	X	X	X-405	SOCKET	5 PRONG	-49356		1			P-7707644 G1		0	0	0	X-405,X-406
X	X	X	X-406	SOCKET	SAME AS X-405	-49356							0	0	0	
X	X	X	X-407	SOCKET	4 PRONG - ISOLANTITE			4	TYPE S4		P-7706776 P6		0	0	0	X-407
X	X	X	X-408	SOCKET	SAME AS X-403								0	0	0	
X	X	X	X-409	SOCKET	SAME AS X-401								0	0	0	

TABLE III

PARTS LIST BY NAVY TYPE NUMBERS FOR MODEL TBM-11 RADIO TRANSMITTING EQUIPMENT

QUANTITY 115 V.D.C.	QUANTITY 230 V.D.C.	QUANTITY 440/3/60	NAVY TYPE NUMBER	ALL SYMBOL DESIGNATIONS INVOLVED
MISCELLANEOUS CLASS 10				
2	2	2		E-211,E-221
1	1	1		E-212
1	1	1		E-213
2	2	2		E-214, E-224
4	4	2		E-214A,E-224A,E-246A,E-247A,E-276A, E-277A
	X			E-214A,E-224A,E-246A,E-247A
X				E-214A,E-224A,E-276A,E-277A
		X		E-214A,E-224A
2	2	2		E-215A,E-225A
2	2	2		E-215B,E-225B
1	1	1		E-217
1	1	1		E-222
1	1	1		E-223
1	1	1		E-226
	1			E-241
1	1			E-242,E-272
	X			E-242
X				E-272
	1			E-243
	1			E-244
	1			E-245
1	1			E-245A,E-275A
	X			E-245A
X				E-275A
1	1			E-246,E-276
	X			E-246
X				E-276
1	1			E-247,E-277
	X			E-247
X				E-277

QUANTITY 115 V.D.C.	QUANTITY 230 V.D.C.	QUANTITY 440/3/60	NAVY TYPE NUMBER	ALL SYMBOL DESIGNATIONS INVOLVED
MISCELLANEOUS (CONTINUED) CLASS 10				
	1			E-248
	1			E-249
	1			E-250
1				E-271
1				E-278
1				E-279
1				E-281
1				E-282
1				E-283
1				E-284
2	2	2		I-1A, I-4A
8	8	8	TS-51	I-1B, I-2B, I-3B, I-4B, I-5B, I-6B, I-401C, I-402C, I-403C
	X			I-1B, I-3B, I-4B, I-5B, I-6B, I-401C, I-402C, I-403C
X		X		I-1B, I-2B, I-3B, I-4B, I-5B, I-401C I-402C, I-403C
2	2	2		I-1C, I-402B
5	4	5		I-2A, I-3A, I-5A, I-401A, I-403A
X		X		I-2A, I-3A, I-5A, I-401A, I-403A
	X			I-3A, I-5A, I-401A, I-403A
4	4	4		I-2C, I-3C, I-6C, I-401B, I-403B
X		X		I-2C, I-3C, I-401B, I-403B
	X			I-3C, I-6C, I-401B, I-403B
1	1	1		I-4C
1	1	1		I-5C
1	2	1		I-6A, I-402A
	X			I-6A, I-402A
X		X		I-402A

QUANTITY 115 V.D.C.	QUANTITY 230 V.D.C.	QUANTITY 440/3/60	NAVY TYPE NUMBER	ALL SYMBOL DESIGNATIONS INVOLVED
MISCELLANEOUS (CONTINUED) CLASS 10				
2	2	2		O-203,O-223,O-241,O-273
		X		O-203,O-223
	X			O-223,O-241
X				O-223,O-273
1	1	1		O-213
RECTOX CLASS 20				
1	1	1		RX-401
2	2	2		RX-402,RX-403
BLOWER MOTOR CLASS 21				
		1	-21130B	B-11
1	1		-21131B	B-1
		1		B-11A
1	1			B-1A
1	1			B-1B
ELECTRICAL INDICATING INSTRUMENTS CLASS 22				
1	1	1	-22035	M-1
1	1	1	-22056	M-8
3	3	3	-22059	M-3,M-5,M-7
5	5	5	-22065	M-4,M-6,M-402,M-403,M-404
1	1	1	-22067	M-2
2	2	2	-22080	M-11,M-406
1	1	1	-22199C	M-10

TABLE III

PARTS LIST BY NAVY TYPE NUMBERS FOR MODEL TBM-11 RADIO TRANSMITTING EQUIPMENT

QUANTITY 115 V.D.C.	QUANTITY 230 V.D.C.	QUANTITY 440/3/60	NAVY TYPE NUMBER	ALL SYMBOL DESIGNATIONS INVOLVED
ELECTRICAL INDICATING INSTRUMENTS (CONTINUED) CLASS 22				
1	1	1	-22225	M-12
1	1	1	-22229A	M-405
1	1	1	-22311	M-9
1	1	1	-22318	M-401
SWITCHES CLASS 24				
5	5	5	-24067	S-14,S-15,S-16,S-406,S-407
1	1	1	-24069A	S-10
1	1	1	-24072	S-12
1	1	1	-24085	S-404
2	2	2	-24086	S-7,S-403
4	4	4	-24095A	S-3A,S-3B,S-3C,S-27
1	1	1		S-1A
1	1	1		S-1B
1	1	1		S-1C
1	1	1		S-2A
1	1	1		S-2B
1	1	1		S-2C
1	1	1		S-2D
1	1	1		S-2E
1	1	1		S-4A,S-4B
1	1	1		S-5A,S-5B,S-5C
1	1	1		S-6
1	1	1		S-8

QUANTITY 115 V.D.C.	QUANTITY 230 V.D.C.	QUANTITY 440/3/60	NAVY TYPE NUMBER	ALL SYMBOL DESIGNATIONS INVOLVED
SWITCHES (CONTINUED) CLASS 24				
1	1	1		S-9,S-9A
				S-11 (SEE CLASS 40)
				S-13 (SEE CLASS 40)
1	1	1		S-17
1	1	1		S-18
		1		S-19
1	1			S-21
1	1	1		S-401
1	1	1		S-402
1	1	1		S-405
1	1	1		S-408
1	1	1		S-409
1	1	1		S-410
FUSES CLASS 28				
2	2	2		F-1,F-2
		2		F-13,F-14
1	1	1		F-211
3	3	3		F-212,F-401,F-402
1	1	1		F-221
1	1	1		F-222
1 X	1 X	1 X		F-841,F-851,F-861 F-841 F-851 F-861

QUANTITY 115 V.D.C.	QUANTITY 230 V.D.C.	QUANTITY 440/3/60	NAVY TYPE NUMBER	ALL SYMBOL DESIGNATIONS INVOLVED
RELAYS AND CONTACTORS CLASS 29				
1	1	1	-29058	K-2
1	1		-29062	K-9
		1	-29063	K-19
1	1		-29064	K-4
1	1	1	-29091	K-401
		1	-29129	K-14
1	1	1	-29169	K-1
1	1	1	-29195	K-5
1	1	1	-29196	K-7
		1		K-8
1	1			K-20
1 X	1 X			K-841,1-851 K-841 K-851
2 X	2 X			K-842,K-843,K-852,K-853 K-842,K-843 K-852,K-853
1				K-844
	1			K-854
		1		K-861
		1		K-862
TRANSFORMERS CLASS 30				
		1	-30300	T-15
		1	-30301	T-14
1	1	1	-30302	T-1
		1	-30303	T-12

TABLE III

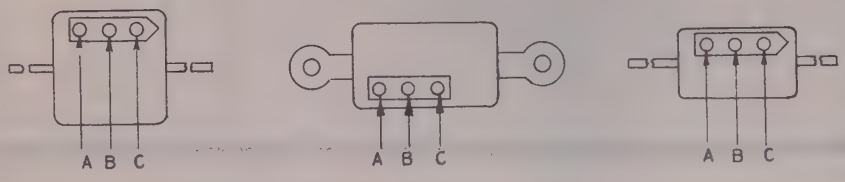
PARTS LIST BY NAVY TYPE NUMBERS FOR MODEL TBM-11 RADIO TRANSMITTING EQUIPMENT

QUANTITY 115 V.D.C.	QUANTITY 230 V.D.C.	QUANTITY 440/3/60	NAVY TYPE NUMBER	ALL SYMBOL DESIGNATIONS INVOLVED
			TRANSFORMERS (CONTINUED) CLASS 30	
1	1	1	-30495	T-409
1	1	1	-30557	T-406
1	1	1	-30559	L-404
1	1	1	-30558	T-405
1	1	1	-30560	T-404
1	1	1	-30561	T-408
3	3	3	-30562	L-401, L-406, L-407
1	1	1	-30563	T-401
1	1	1	-30564	T-403
1	1	1	-30565	T-402
1	1	1	-30566	L-402
1	1	1	-30568	L-405
1	1	1	-30569	L-408
1	1	1	-30570	L-407
1	1	1		T-3
			VACUUM TUBES CLASS 38	
2	2	2	-6D6	VT-401, VT-402
1	1	1	-25Z5	VT-409
2	2	2	-803	VT-405, VT-406
3	3	3	-807	VT-403, VT-404, VT-408
3	3	3	-860	VT-1, VT-2, VT-3
1	1	1	-861	VT-4
1	1	1	-1616	VT-407
			THERMOSTATS AND THERMOMETERS CLASS 40	
1	1	1	-40010	S-13
1	1	1	-40025	TH-1
1	1	1	-40034	S-11
			INDUCTORS AND CHOKES CLASS 47	
1	1	1	-30185	L-16
1	1	1	-30567	L-403
1	1	1		L-1
1	1	1		L-2
1	1	1		L-3
1	1	1		L-4
3	3	1		L-5, L-17, L-18
X	X			L-5, L-17, L-18
		X		L-5
2	2	2		L-6, L-8
1	1	1		L-7
1	1	1		L-9
2	2	2		L-10, L-15
1	1	1		L-11
1	1	1		L-12
1	1	1		L-13
1	1	1		L-14
1	1	1		L-19
		1		L-20
			CAPACITORS CLASS 48	
1	1	1	-48001-10	C-67
10	10	10	-48027-10	C-4, C-5, C-8, C-9, C-17, C-18, C-26, C-27, C-35, C-36
2	2	2	-48035-10	C-19, C-28
6	6	6	-48037-10	C-12, C-16, C-25, C-33, C-34, C-37
1	1	1	-48039-10	C-15
2	2	2	-48197-A10	C-402, C-424
1	1	1	-48204-D2	C-7
1	1	1	-48205-A10	C-60
1	1	1	-48218-5	C-44
1	1	1	-48330-10	C-22
4	4	4	-48340	C-401, C-417, C-418, C-423
1	1	1	-48365-D2	C-2
2	2	2	-48382-10	C-20, C-30
17	17	17	-48410-10	C-10, C-11, C-23, C-24, C-31, C-32, C-43, C-46, C-50, C-51, C-52, C-404, C-407, C-409, C-410, C-413, C-416
1	1	1	-48423-5	C-57
1	1	1	-48428-10	C-414
2	2	2	-48477-D2	C-1, C-3
1	1	1	-48478-B5	C-6
1	1	1	-48481-D2	C-56
2	2	2	-48526	C-408, C-411
1	1	1	-48534-5	C-54
1	1	1	-48535-5	C-53
2	2	2	-48591-10	C-405, C-412

TABLE IV
APPLICABLE COLOR CODES AND MISCELLANEOUS DATA
FOR TBM-11 RADIO TRANSMITTING EQUIPMENT

COLOR CODE IN MMFD. FOR CAPACITORS

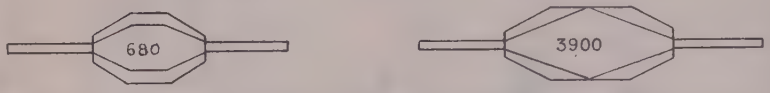
COLOR	1ST DIGIT A	2ND DIGIT B	CIPHERS C
BLACK	-	0	.0
BROWN	1	1	0
RED	2	2	00
ORANGE	3	3	000
YELLOW	4	4	0000
GREEN	5	5	00000
BLUE	6	6	000000
PURPLE	7	7	0000000
GRAY	8	8	00000000
WHITE	9	9	--



RCA COLOR CODED CAPACITORS CAPACITY IN MMFD.

VALUES DESIGNATE TOLERANCE BY COLOR

YELLOW ±20% BLUE ±10% BLACK ±5%

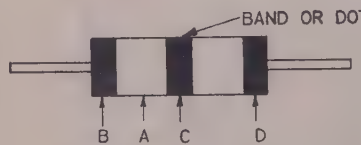


RMA COLOR CODE FOR RESISTORS

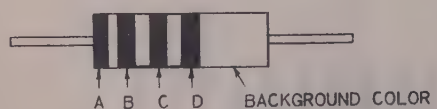
COLOR	1ST DIGIT A	2ND DIGIT B	CIPHERS C
BLACK	-	0	.0
BROWN	1	1	0
RED	2	2	00
ORANGE	3	3	000
YELLOW	4	4	0000
GREEN	5	5	00000
BLUE	6	6	000000
PURPLE	7	7	0000000
GRAY	8	8	00000000
WHITE	9	9	--

D- TOLERANCE CODE:

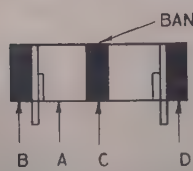
GOLD = 5% SILVER =10% OMIT = 20%



ORIGINAL COLOR ARRANGEMENT FOR AXIAL LEADS



NEW COLOR ARRANGEMENT FOR AXIAL LEADS



STANDARD COLOR ARRANGEMENT FOR RADIAL LEADS

TABLE V
LIST OF MANUFACTURERS
FOR TBM-11 RADIO TRANSMITTING EQUIPMENT

CODE NUMBER	MFR. PREFIX	NAME	ADDRESS
1	CAY	WESTINGHOUSE ELEC. & MFG. CO.	2519 WILKENS AVENUE BALTIMORE, MD.
2	CD	CORNELL-DUBILIER ELEC. CORP.	SOUTH PLAINFIELD, N. J.
	CAW	AEROVOX CORP.	NEW BEDFORD, MASS.
3	CMR	MICAMOLD RADIO CO.	BROOKLYN, N. Y.
	CSF	SPRAGUE SPECIALTIES CO.	NORTH ADAMS, MASS.
	CAN	SANGAMO ELEC. CO.	SPRINGFIELD, ILL.
	CD	CORNELL-DUBILIER ELEC. CORP.	SOUTH PLAINFIELD, N. J.
	CSL	SOLAR MFG. CO.	586 AVENUE "A" BAYONNE, N. J.
	CAW	AEROVOX CORP.	NEW BEDFORD, MASS.
4	CHC	HAMMARLUND MFG. CO.	424 W. 33RD STREET NEW YORK, N. Y.
5	CBK	ALLEN D. CARDWELL	81 PROSPECT STREET BROOKLYN, N. Y.
6	CSL	SOLAR MFG. CO.	BAYONNE, N. J.
7	CD	CORNELL-DUBILIER ELEC. CORP.	SOUTH PLAINFIELD, N. J.
8	CBU	ISOLANTITE, INC.	BELLEVILLE, N. J.
	CAS	AMERICAN LAVA CORP.	CHATTANOOGA, TENN.
9	CFA	BUSSMAN MFG. CO.	ST. LOUIS, MO.
		CHASE SHAWMUT	MERRIMAC STREET NEWBURYPORT, MASS.
10	CLF	LITTELFUSE, INC.	4757 RAVENSWOOD AVENUE CHICAGO, ILL.
11	CFA	BUSSMAN MFG. CO.	ST. LOUIS, MO.
12	CAU	AUTOMATIC ELEC. CO.	1033 W. VAN BUREN STREET CHICAGO, ILL.
13	CN	NATIONAL ELEC. MACHINE SHOPS	WASHINGTON, D. C.
14	CSD	STRUTHERS-DUNN, INC.	139 N. JUNIPER STREET PHILADELPHIA, PA.
15	CKU	KURMAN ELEC. CO.	241 LAFAYETTE STREET NEW YORK, N. Y.
16	CNA	NATIONAL CO.	MALDEN, MASS.
17	CAO	WARD-LEONARD ELEC. CO.	MT. VERNON, N. Y.
	CHD	HARDWICK-HINDLE, INC.	65 JOHNSON STREET NEWARK, N. J.
18	CSA	STACKPOLE CARBON CO.	ST. MARY'S, PA.
	CCC	CONTINENTAL CARBON CO.	13900 LORAIN AVENUE CLEVELAND, OHIO
	CPQ	SPEER CARBON CO.	ST. MARY'S, PA.
19	CAO	WARD-LEONARD ELEC. CO.	MT. VERNON, N. Y.
20	CCC	CONTINENTAL CARBON CO.	13900 LORAIN AVENUE CLEVELAND, OHIO
21	CDN	DAVEN CO.	158 SUMMIT STREET NEWARK, N. J.
	CQT	TECH LABORATORIES	7 LINCOLN STREET JERSEY CITY, N. J.

TABLE V

LIST OF MANUFACTURERS
FOR TBM-11 RADIO TRANSMITTING EQUIPMENT

CODE NUMBER	MFR. PREFIX	NAME	ADDRESS
22	CIR	INTERNATIONAL RESISTANCE CO.	401 N. BROAD STREET PHILADELPHIA, PA.
23	CSF	SPRAGUE SPECIALTIES CO.	NORTH ADAMS, MASS.
24	CDM	D. P. MOSSMAN, INC.	6021 N. NORTHWEST HIGHWAY CHICAGO, ILL.
	CGC	GENERAL CONTROL CO.	243 BROADWAY CAMBRIDGE, MASS.
25	CPT	PRECISION INSTRUMENT & THERMOMETER CO.	1434 BRANDYWINE STREET PHILADELPHIA, PA.
26	CW	WESTERN ELECTRIC CO.	LEXINGTON AVENUE AT 43RD ST. NEW YORK, N. Y.
27		BRYANT ELEC. CO.	BRIDGEPORT, CONN.
28	CHH	ARROW, HART & HEGEMAN	HARTFORD, CONN.
29	CHB	H. B. INSTRUMENT CO., INC.	2520 N. BROAD STREET PHILADELPHIA, PA.
30	CWL	WESTINGHOUSE LAMP CO.	BLOOMFIELD, N. J.
31	CRC	RCA RADIOTRON CORP.	HARRISON, N. J.
32	CLE	LENZ ELEC. MFG. CO.	1751 NORTH WESTERN AVENUE CHICAGO, ILL.
33	CEJ	E. F. JOHNSON	WASECA, MINN.

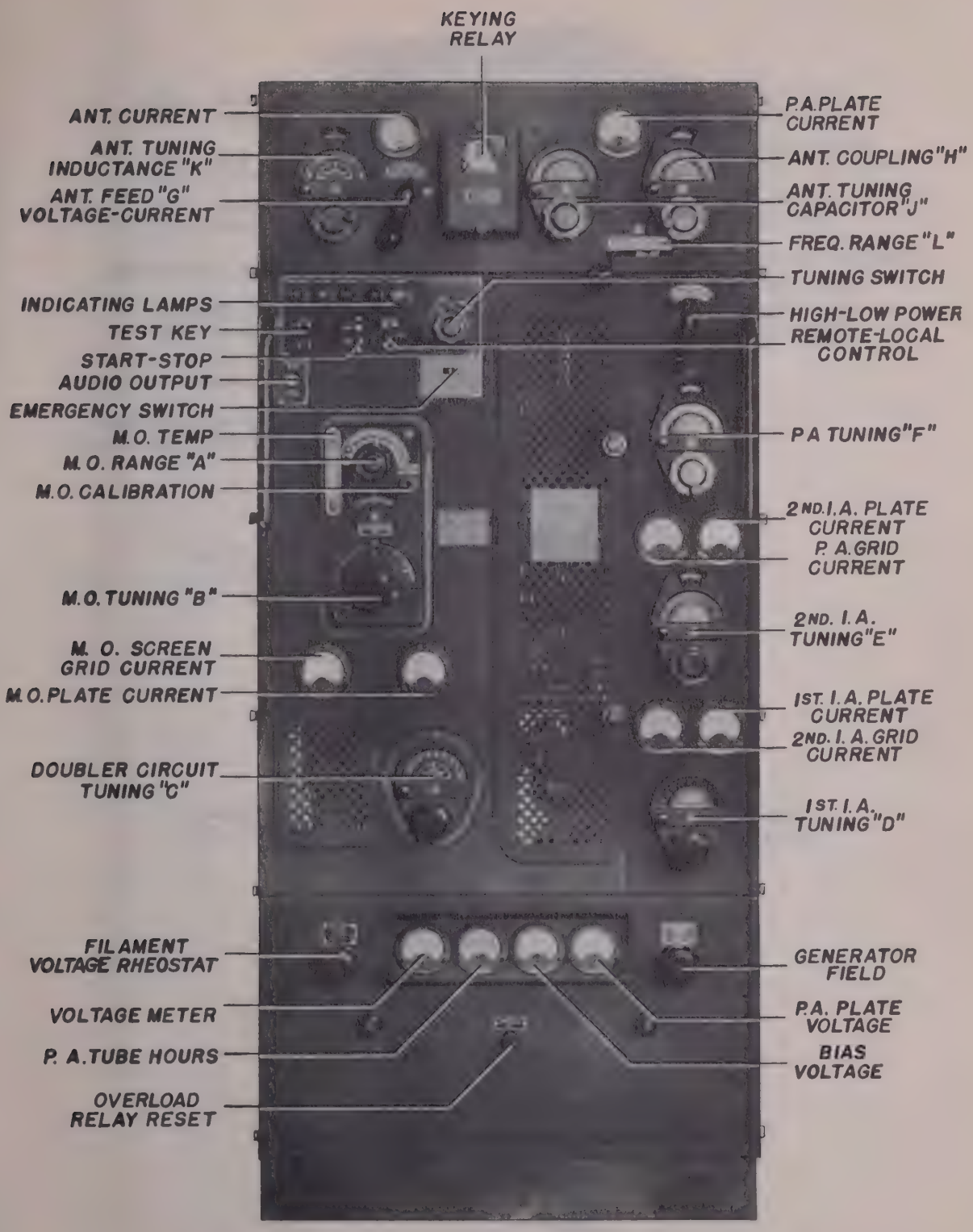
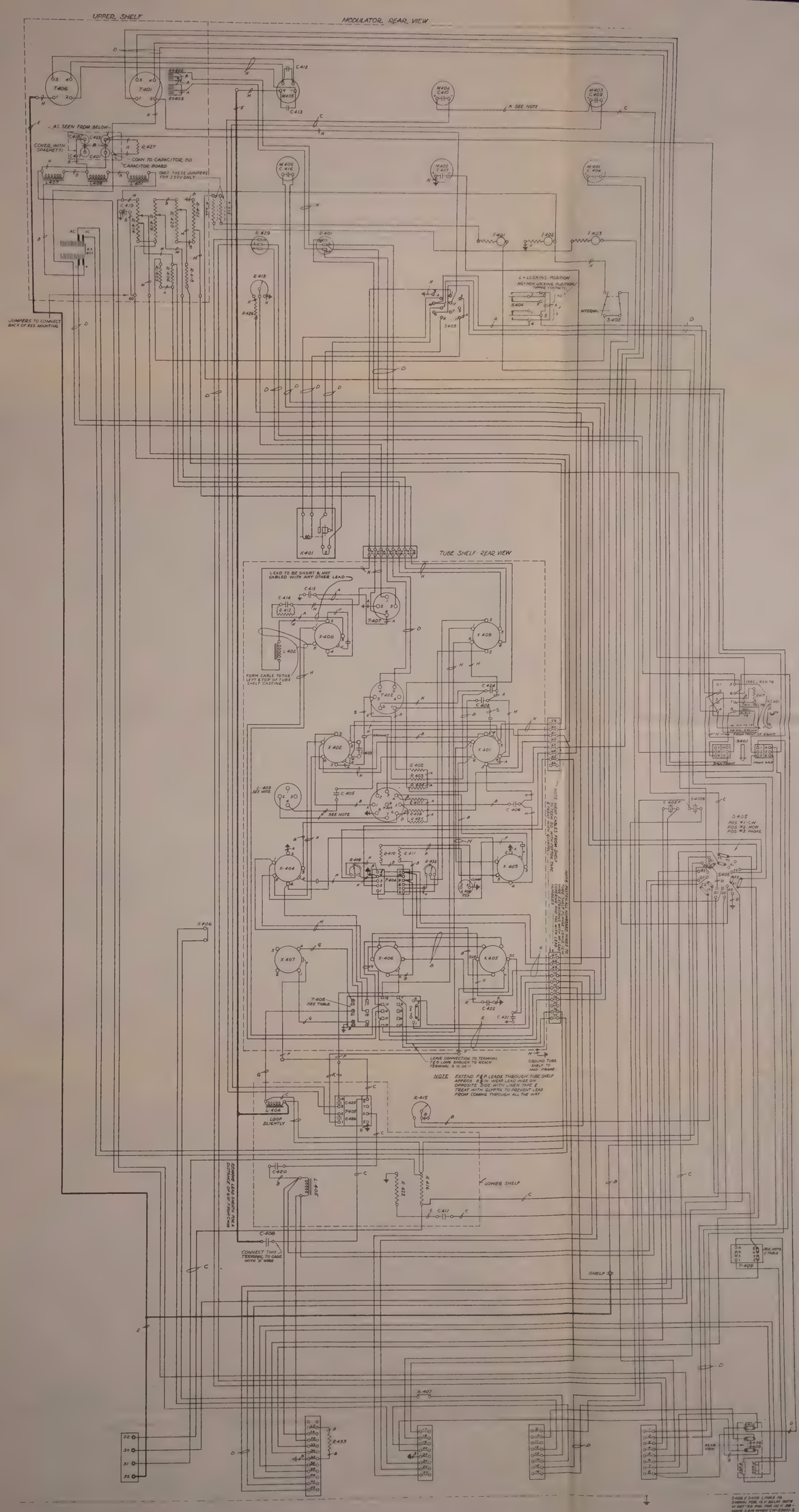


FIG. 1. TRANSMITTER UNIT TYPE CAY-52217, 115 V. D.C. OPERATION, AND TYPE CAY-52218, 230 V. D.C. OPERATION, FRONT VIEW. (Photo C-5082)



T-409 PRI LINKS & CONNECTIONS
LEAVE SEC LINKS ON 547-648

POWER SUPPLY		PRI LINKS ON TERMINALS	CONNECT
VOLTS	CYCLES		
440	60	7-2	AS SHOWN
220	60	1 3 & 2 4	AS SHOWN
230	DC	1 3 & 2 4	AS SHOWN
115	DC	3-2	LEAD #1 TO TERM #5 LEAD #6 TO TERM #8

T-408 LINKS

POWER SUPPLY		VOLTS ON TERMINALS	LINKS ON
VOLTS	CYCLES		
440	60	100	1-4 & 3-6
220	60	100	1-4 & 3-6
230	DC	70	1-3 & 2-6
115	DC	70	1-5 & 2-6

WIRE LEGEND

A - #16 TINNED COPPER WIRE, NEED NOT BE INSULATED FROM GROUND AND OTHER WIRES & MAY BE SHORT AS PRACTICABLE
B - #12 " " " " " " " " " " " " " "
C - VC L.C. CABLE, T.I.C. 0403 (A3001) PDS #7277
D - DUPLEX L.C. CABLE
E - COPPER TUBING 1/8 I.D. X 1/4 O.D. PDS #7443-1
F - ALDEN 9418 TUBE CAP WITH #18 V.C. LEADS 10" LONG
G - FLEXIBLE CABLE, 9 MM. PACKARD CABLE #341
H - 2500 VOLT WIRE
J - USE M WIRE
K - USE M WIRE
M - 5000 VOLT WIRE
N - WIRE #18 OF 1007 P.D.S. #7423-13
P - ALDEN SIZE TUBE CAP WITH #18 V.C. LEADS 20" LONG
R - WIRE #14 OF D.C. WIRE (P.D.S. 8068) 7" LG. WITH COTTON BRAID COVERING, 20" LG.
S - #16 TINNED COPPER WIRE, NEED NOT BE INSULATED FROM GROUND AND OTHER WIRES & MAY BE SHORT AS PRACTICABLE
NOTE - UNMARKED WIRES ARE #18 V.C. CABLE
NOTE - ON ALL METER CONNECTIONS LEAVE 1 1/2" OF WIRE WITHOUT INSULATION ENOUGH TO PREVENT BENDING INSULATION AWAY FROM PLATE AFTER WIRING
NOTE - BRAID TERMINALS 2 & 7 - SHOULD BE AWAY FROM PLATE AFTER WIRING
NOTE - T-409 LEAD #1 - 11 IN. LONG ENOUGH TO REACH TERMINAL #5
NOTE - T-409 LEAD #4 - 18" LONG ENOUGH TO REACH TERMINAL #8
NOTE - MAKE #2 CONNECTION TO L-403 LONG ENOUGH TO REACH TERMINAL #1
NOTE - MAKE #4 CONNECTION TO L-403 LONG ENOUGH TO REACH TERMINAL #3

FOR WIRE BILL SEE 7707840

T-408 & T-409 LINKS AS SHOWN FOR 115 V DELAY BOTH M DET & PHL PHS SET AT .08". NOTE 3 ILM WHEN CW-23070-B UNITS ARE USED.

FIG. 34. WIRING DIAGRAM, MODULATOR UNIT, TYPE CAY-50065-A.
(Dwg. W-7300535)

INSTALLATION PLAN

NAVY TYPE NO.	WEIGHT (POUNDS) CRATED	WEIGHT (POUNDS) UNCRATED	CUBICAL CONTENT (CU. FT.) CRATED
CAY- 52217	1035	789	56.97
CAY- 52218	1035	789	56.97
CAY- 52170	1035	789	56.87
CAY- 52171	1035	789	56.97

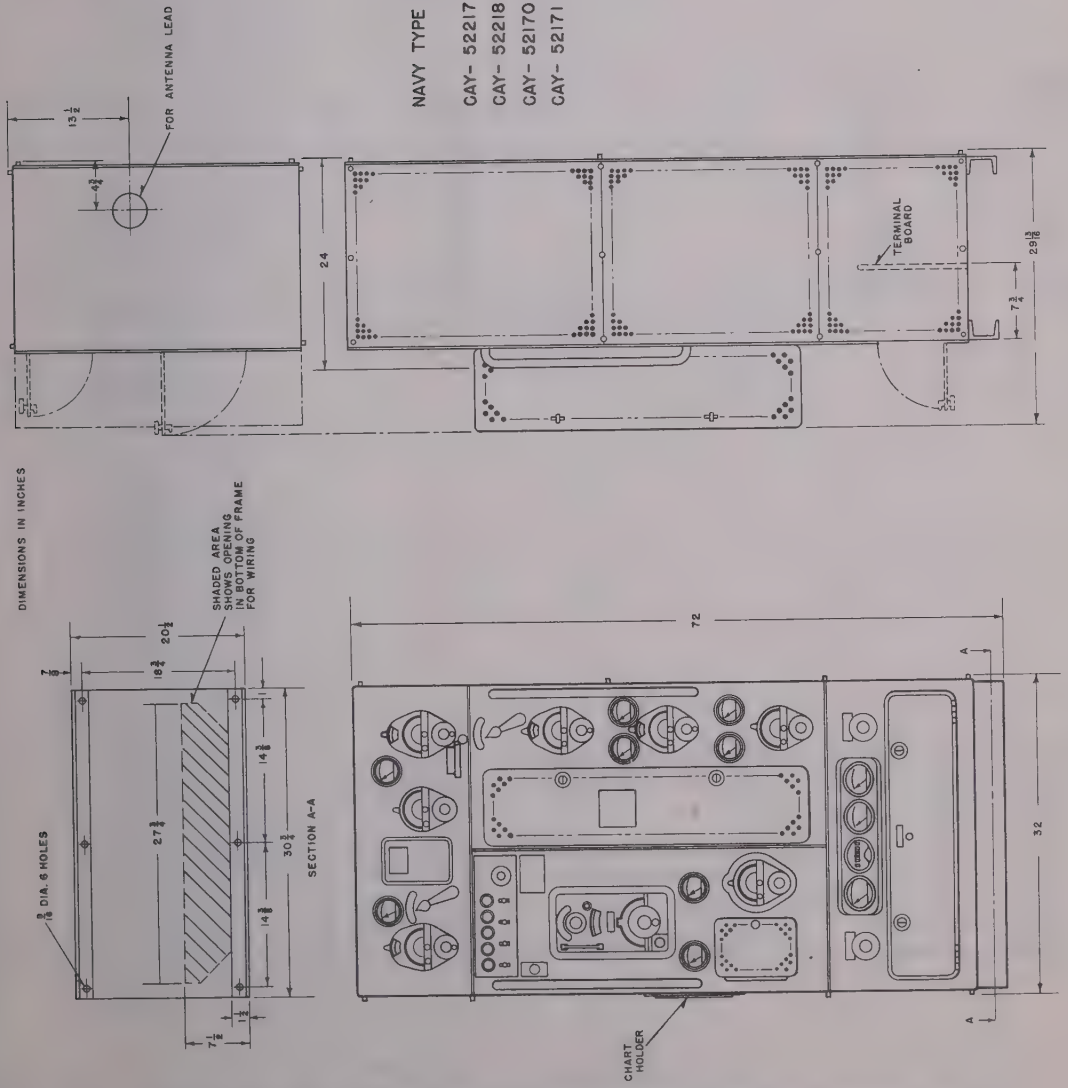
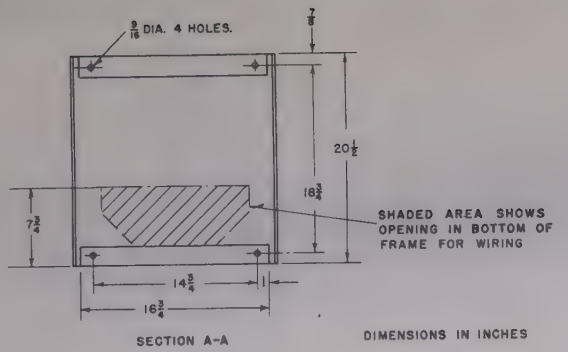
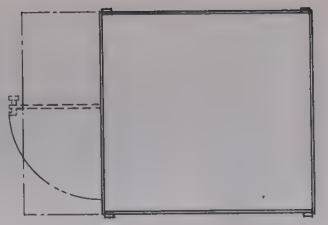
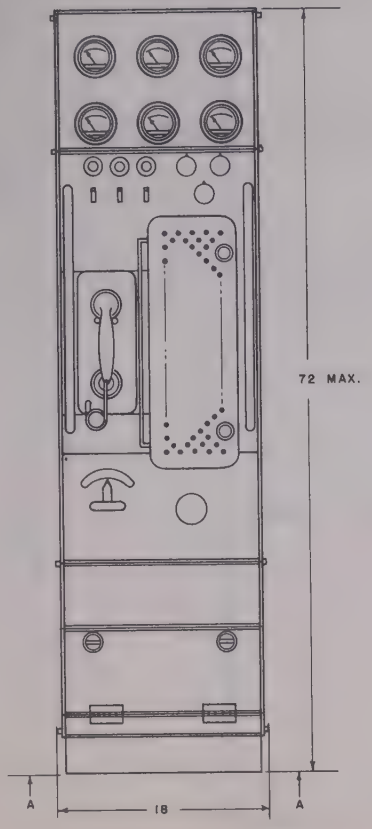
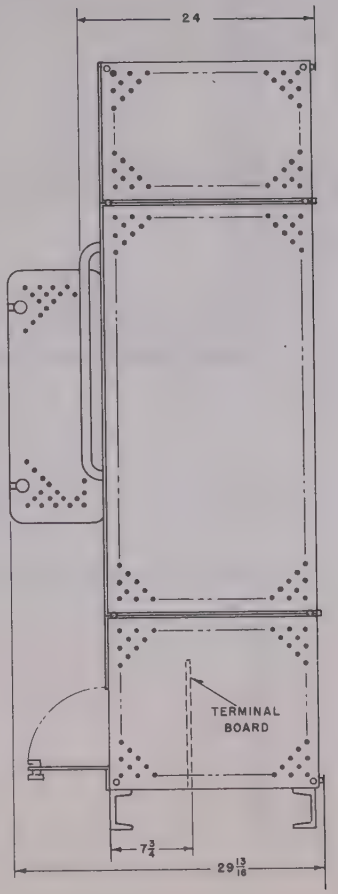


FIG. 35. OUTLINE AND MOUNTING DIMENSIONS, TRANSMITTER UNIT, TYPE CAY-52217, 115 V. D.C. OPERATION, TYPE CAY-52218, 230 V. D.C. OPERATION, AND TYPE CAY-52171, 440 V., 3 PHASE, 60 CYCLE OPERATION. (Dwg. T-7611719)





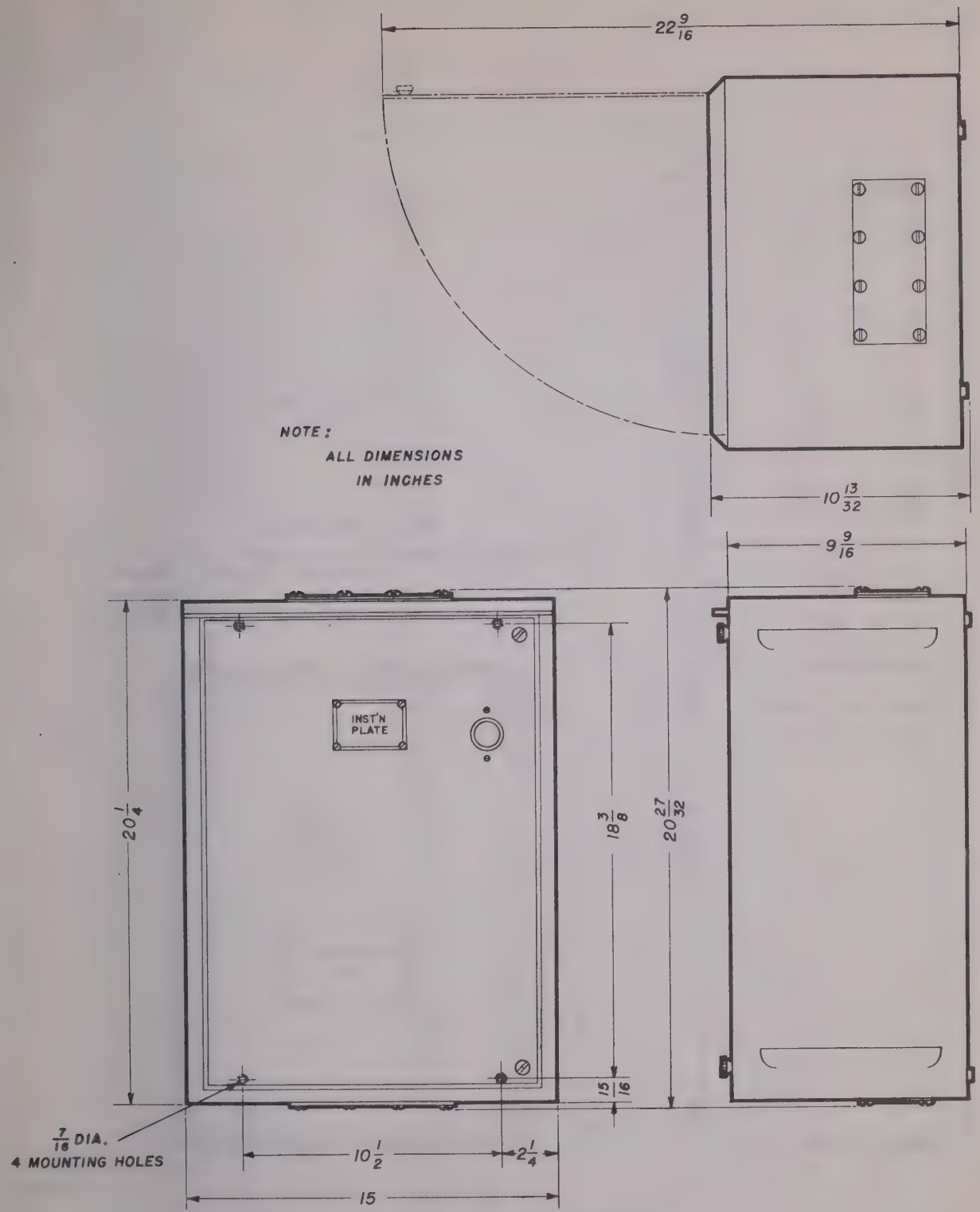




INSTALLATION PLAN

WEIGHT (POUNDS).		CUBICAL CONTENT (CU. FT.)
UNCRATED	CRATED	CRATED
380	600	31.42

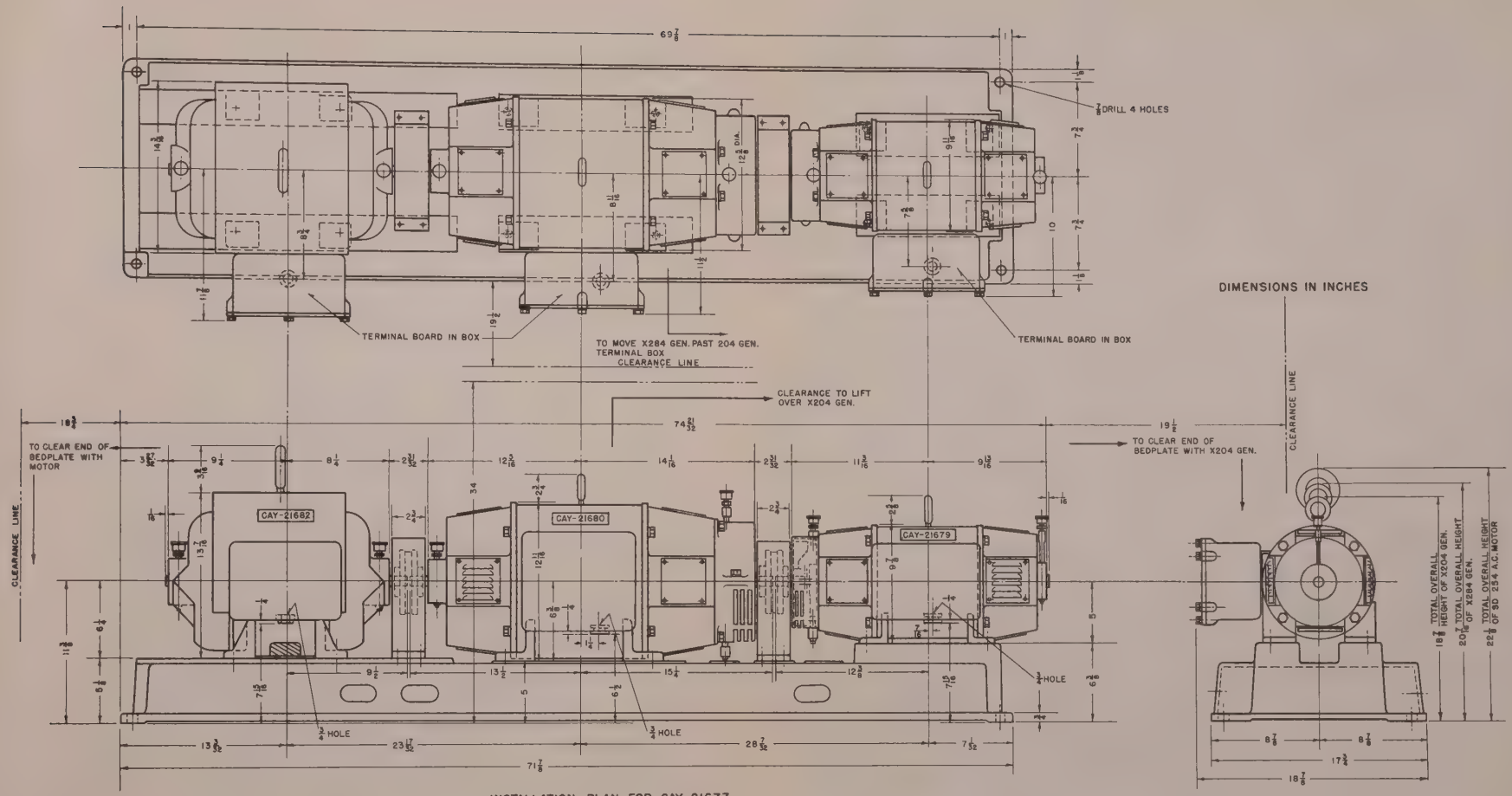
FIG. 36. OUTLINE DRAWING, MODULATOR UNIT, TYPE CAX-50065-A (Dwg. P-7711695)



INSTALLATION PLAN

NAVY TYPE NUMBER	WEIGHT (POUNDS) CRATED	WEIGHT (POUNDS) UNCRATED	CUBICAL CONTENT (CU.FT.) CRATED
CAY-211231		76	
CAY-211232		76	

FIG. 37. OUTLINE AND MOUNTING DIMENSIONS – MAGNETIC CONTROLLER UNIT, TYPE CAY-211231, 115 VOLT D.C. OPERATION AND TYPE CAY-211232, 230 VOLT D.C. OPERATION (Dwg. P-7713319)

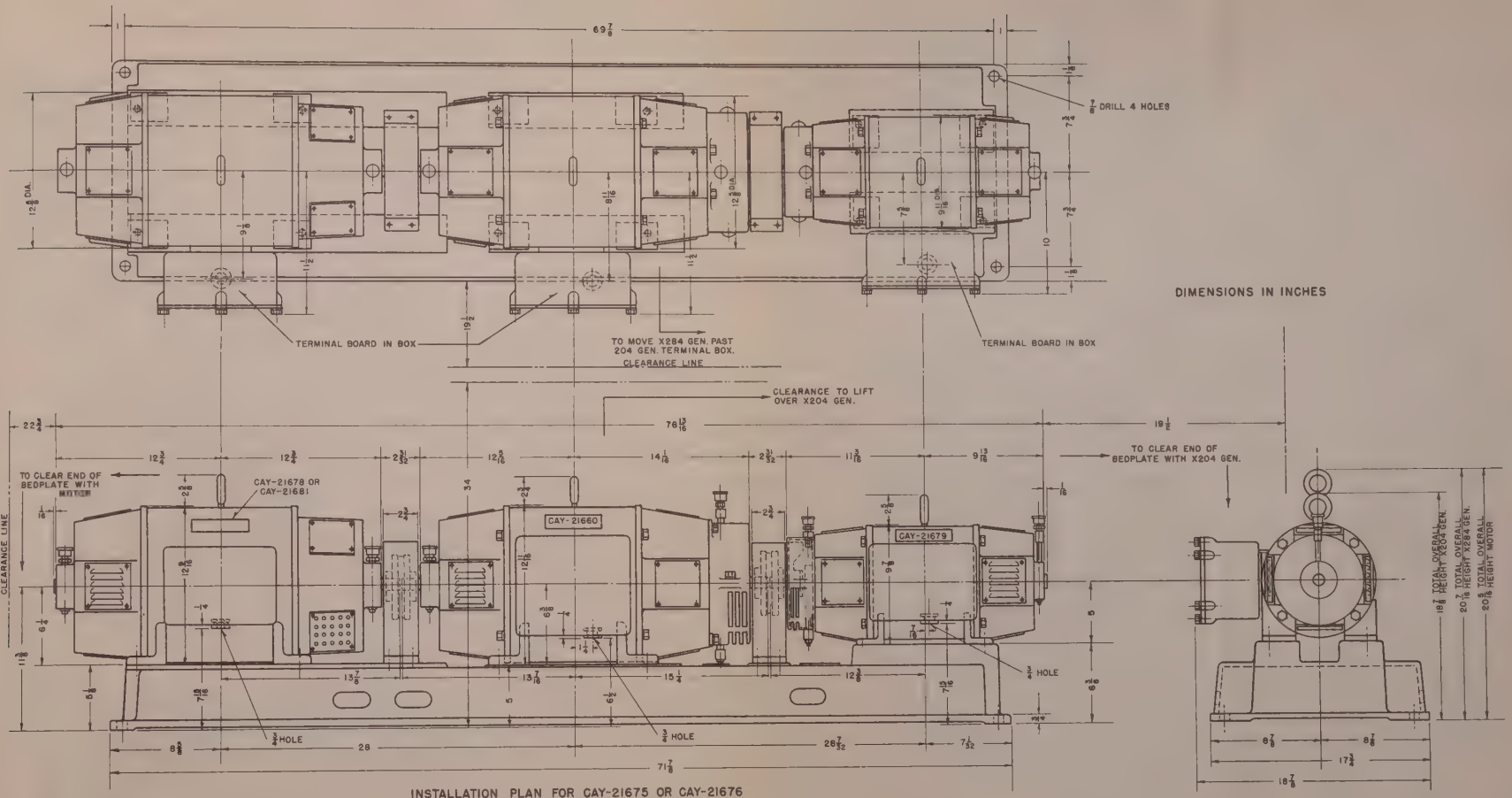

DIMENSIONS IN INCHES
DRILL 4 HOLES
TERMINAL BOARD IN BOX
TERMINAL BOARD IN BOX
TO MOVE X284 GEN. PAST 204 GEN. TERMINAL BOX CLEARANCE LINE
CLEARANCE TO LIFT OVER X204 GEN.
TO CLEAR END OF BEDPLATE WITH MOTOR
TO CLEAR END OF BEDPLATE WITH X204 GEN.
CLEARANCE LINE
CAY-21682
CAY-21680
CAY-21679
¾ HOLE
¾ HOLE
¾ HOLE
TOTAL OVERALL HEIGHT OF X204 GEN.
TOTAL OVERALL HEIGHT OF X284 GEN.
TOTAL OVERALL HEIGHT OF SD 254 A.C. MOTOR

INSTALLATION PLAN FOR CAY-21677

MG SET	CONSISTING OF	WEIGHT (POUNDS) CRATED	WEIGHT (POUNDS) UNCRATED	CUBICAL CONTENT (CU. FT.) CRATED
CAY-21677	CAY-21682 220-440/3/60 MOTOR CAY-21679 L.V. & BIAS D.C. GENERATOR CAY-21680 H.V. D.C. GENERATOR	1260	1025	29.42

NAVY TYPE CAY-21682 A.C. MOTOR-CS-SD254-4 POLE-5 HP-1750 R.P.M.-220/440 VOLTS-3PH-60 CYC.
NAVY TYPE CAY-21679 GEN.-SK-X204-2 POLE-.076/253 KW-1750 R.P.M.-1000/275 VOLTS D.C.-.075/.92 AMP.
NAVY TYPE CAY-21680 GEN.-SK-X284-2/2 POLE-1.05/1.5 KW-1750 R.P.M.-3000/2000 VOLTS D.C.-.35/.75 AMP.

FIG. 39. OUTLINE AND MOUNTING DIMENSIONS, MOTOR-GENERATOR SET, TYPE CAY-21677, 220/440 VOLT, 3 PHASE, 60 CYCLE OPERATION, (Dwg. T-76111739)

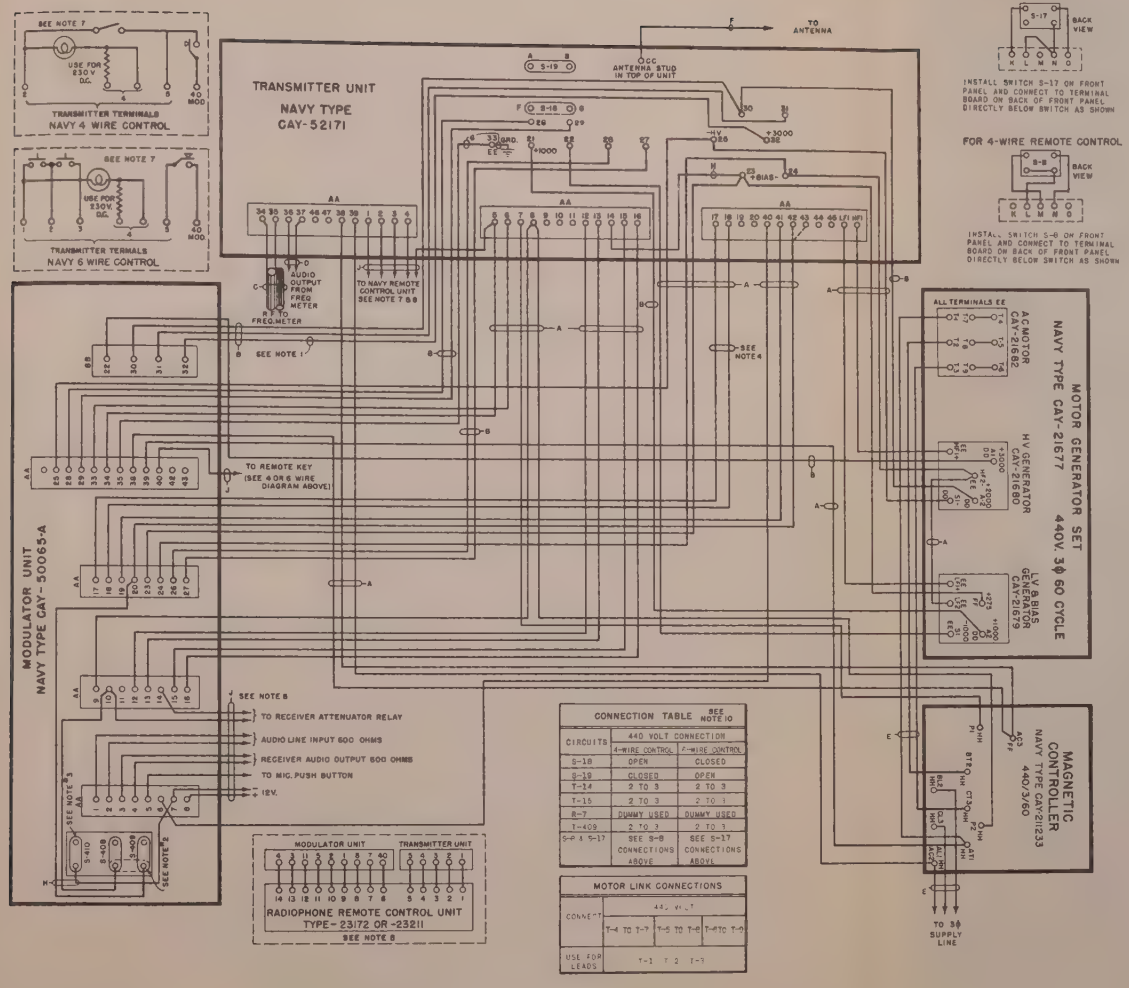

DIMENSIONS IN INCHES
DRILL 4 HOLES
TERMINAL BOARD IN BOX
TO MOVE X284 GEN. PAST 204 GEN. TERMINAL BOX.
CLEARANCE LINE
CLEARANCE TO LIFT OVER X204 GEN.
TO CLEAR END OF BEDPLATE WITH X204 GEN.
TO CLEAR END OF BEDPLATE WITH MOTOR
CAY-21678 OR CAY-21681
CAY-21660
CAY-21679
¾ HOLE
TOTAL OVERALL HEIGHT X204 GEN.
TOTAL OVERALL HEIGHT X284 GEN.
TOTAL OVERALL HEIGHT MOTOR

INSTALLATION PLAN FOR CAY-21675 OR CAY-21676

MG SET	CONSISTING OF	WEIGHT (POUNDS) CRATED	WEIGHT (POUNDS) UNCRATED	CUBICAL CONTENT (CU. FT.) CRATED
CAY-21675	CAY-21678 115V D.C. MOTOR CAY-21679 L.V. & BIAS D.C. GENERATOR CAY-21680 H.V. D.C. GENERATOR	1335	1093	2942
CAY-21676	CAY-21681 230V D.C. MOTOR CAY-21679 L.V. & BIAS D.C. GENERATOR CAY-21680 H.V. D.C. GENERATOR	1335	1093	2942

NAVY TYPE CAY-21678 D.C. MOTOR SK-X259-4/2 POLE-5HP.-1800 R.P.M. 115VOLTS 44 AMPS.
NAVY TYPE CAY-21681 D.C. MOTOR SK-X254-4/2 POLE-5HP.-1800 R.P.M. 230VOLTS 22 AMPS.
NAVY TYPE CAY-21680 GENERATOR SK-X284-2/2 POLE-1.05/1.5 KW. 1800 R.P.M. 3000/2000 VOLTS, D.C.-35/75 AMPS.
NAVY TYPE CAY-21679 GENERATOR SK-X204-2 POLE-.075/253 KW 1800 R.P.M. 1000/275 VOLTS D.C-.075/92 AMPS.

FIG. 40. OUTLINE AND MOUNTING DIMENSIONS, MOTOR-GENERATOR SET, TYPE CAY-21678, 230 VOLT D.C. OPERATION AND MOTOR-GENERATOR SET, TYPE CAY-21675, 115 VOLT D.C. OPERATION. (Dwg. T-7611738)


TRANSMITTER UNIT
NAVY TYPE
CAY-52171
TO ANTENNA
ANTENNA STUD IN TOP OF UNIT
MODULATOR UNIT
NAVY TYPE CAY-50065-A
MOTOR GENERATOR SET
NAVY TYPE CAY-21677
440V. 3Ø 60 CYCLE
AC MOTOR CAY-21682
HV GENERATOR CAY-21680
LV & BIAS GENERATOR CAY-21679
MAGNETIC CONTROLLER
NAVY TYPE CAY-21233
440/3/60
TO 3Ø SUPPLY LINE
TO RECEIVER ATTENUATOR RELAY
AUDIO LINE INPUT 600 OHMS
RECEIVER AUDIO OUTPUT 600 OHMS
TO MIC. PUSH BUTTON
+12V.
TO REMOTE KEY (SEE 4 OR 6 WIRE DIAGRAM ABOVE)
AUDIO OUTPUT FROM FREQ METER
TO FREQMETER
TO NAVY REMOTE CONTROL UNIT SEE NOTE 7 & 8
RADIOPHONE REMOTE CONTROL UNIT TYPE-23172 OR-23211
SEE NOTE 9
TRANSMITTER TERMINALS
NAVY 4 WIRE CONTROL
TRANSMITTER TERMALS
NAVY 6 WIRE CONTROL
USE FOR 230 V D.C.
SEE NOTE 7
SEE NOTE 1
SEE NOTE 4
SEE NOTE 5
SEE NOTE 6
SEE NOTE 2
SEE NOTE 3
ALL TERMINALS EE
FOR 6-WIRE REMOTE CONTROL
S-17
BACK VIEW
INSTALL SWITCH S-17 ON FRONT PANEL AND CONNECT TO TERMINAL BOARD ON BACK OF FRONT PANEL DIRECTLY BELOW SWITCH AS SHOWN
FOR 4-WIRE REMOTE CONTROL
S-8
BACK VIEW
INSTALL SWITCH S-8 ON FRONT PANEL AND CONNECT TO TERMINAL BOARD ON BACK OF FRONT PANEL DIRECTLY BELOW SWITCH AS SHOWN

CONNECTION TABLE (SEE NOTE 10)		
CIRCUITS	440 VOLT CONNECTION	
	4-WIRE CONTROL	6-WIRE CONTROL
S-18	OPEN	CLOSED
S-19	CLOSED	OPEN
T-14	2 TO 3	2 TO 3
T-15	2 TO 3	2 TO 3
R-7	DUMMY USED	DUMMY USED
T-409	2 TO 3	2 TO 3
S-8 & T-17	SEE S-8 CONNECTIONS ABOVE	SEE S-17 CONNECTIONS ABOVE

MOTOR LINK CONNECTIONS			
CONNECT	440 VOLT		
	T-4 TO T-7	T-5 TO T-8	T-6 TO T-9
USE FOR LEADS	T-1 T 2 T-3		

ANTENNA DATA

MAXIMUM LENGTH OF ANTENNA	80 FT.
MAXIMUM LENGTH OF TRUNK	25 FT.
MINIMUM LENGTH OF TRUNK	NONE
DIAMETER OF TRUNK	8 TO 12 INCHES
MAXIMUM DISTANCE TO ENTERING INSULATOR	20 FT.
MINIMUM DISTANCE TO ENTERING INSULATOR	2 FT.
CAPACITY 500 TO 1000 MMFD.	RESISTANCE (R.F.) 0 TO 30 OHMS

POWER REQUIREMENTS

POWER SUPPLY	220/440 V. 3 Ø 60 CYCLES
ALLOWABLE VARIATION IN LINE VOLTAGE	±10%
ALLOWABLE VARIATION IN LINE FREQUENCY	± 5%
ALLOWABLE COMBINED VARIATION OF VOLTAGE & FREQUENCY	±10%
RATED H.P. OF MOTOR	5 AT 1750 R.P.M.

CONDITION	START	LOCKED KEY	STANDBY
LINE AMPERES PER PHASE	90/45	18.6/6.8	8.8/4.28
KILOWATTS REQUIRED FROM LINE	21	4.8	2.9
KILOVOLT AMPERES REQUIRED FROM LINE	34	8.2	3.4
PER CENT POWER FACTOR	80	82	70

WIRE LEGEND

SYMBOL	CONDUCTOR SIZE CIRCULAR MILS	ALLOWABLE DROP	CURRENT RATING	VOLTAGE RATING	TYPE INSULATION	COMMERCIAL DESIGNATION	NAVY DESIGNATION	NOTES
A	4,494		25	1000	ASBESTOS		SHFA-4	
B	4,494		25	5000	ASBESTOS		SHFR-4	
C	1,758		3	3500	SYN. RESIN		AN-RG-12/U	
D	2,828		8	1000	ASBESTOS		DHFA-3	
E	4,494	3% OF LINE VOLTAGE	25	1000	ASBESTOS		THFA-4	5
F	1/8" TO 1/2" DIA.				NONE			COPPER TUBING SEE 11
J	1"WIDE X 1/32" THK.				NONE			COPPER STRAP PART OF ASSY NO. 1
M								
W	2,828		8	1000	ASBESTOS		MHFA-	1 & 5

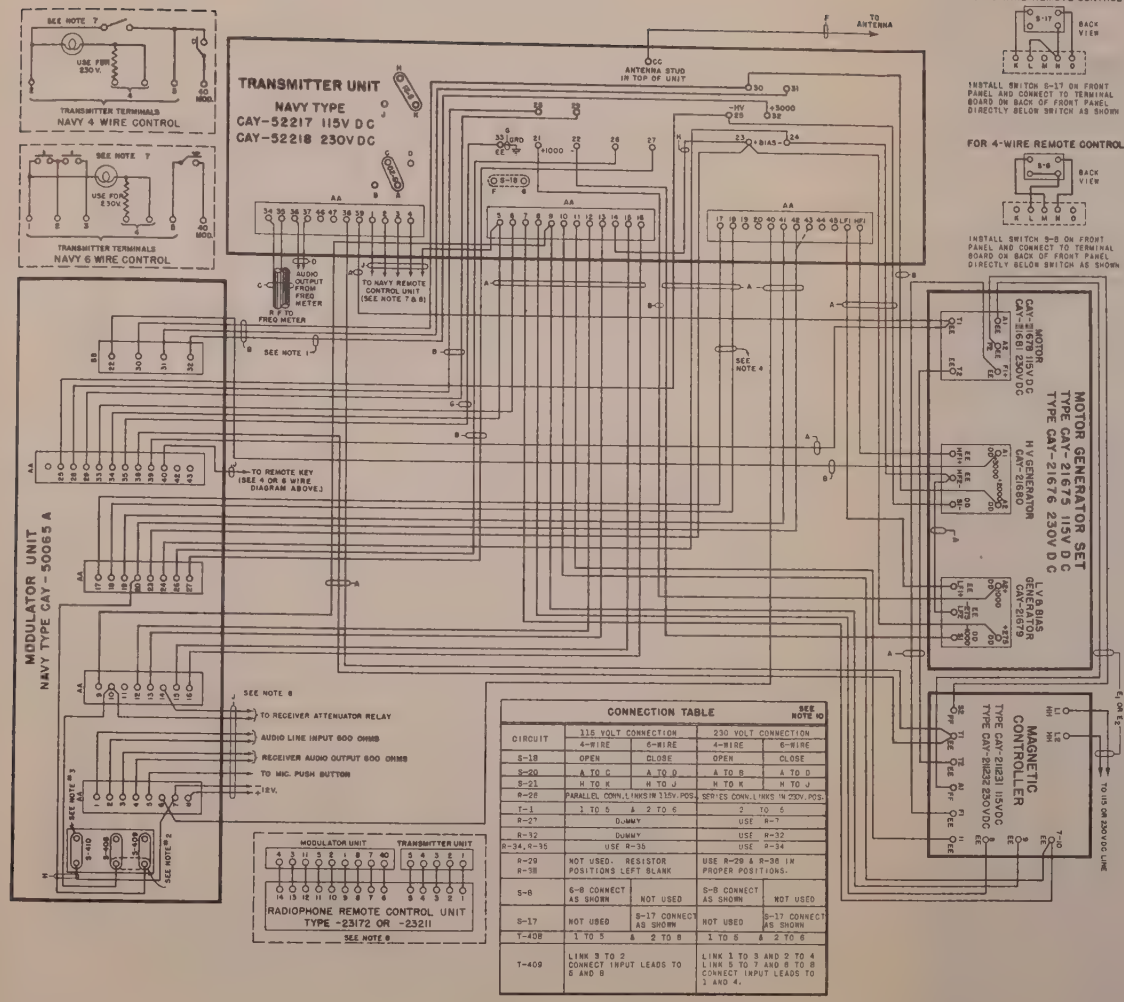
TERMINAL DESIGNATION

SYMBOL	DESCRIPTION	SIZE OF TERMINAL STUD OR SCREW	NOTES
AA	MOLDED TERMINAL STRIP	10 - 32	
BB	CERAMIC LEAD-THRU BUSHINGS IN LAMINATED PHENOLIC BOARD	10 - 32	6
CC	STUD ON STAND-OFF-INSULATOR IN TOP SECTION OF TRANSMITTER	1/4 - 20	
DD	SCREW IN EAR ON FUSE CLIP	10 - 32	
EE	STUD IN LAMINATED PHENOLIC BOARD	10 - 32	
FF	STUD IN CONNECTION STRAP	10 - 32	
GG	STUD IN LAMINATED PHENOLIC BOARD	1/4 - 20	
HH	CONNECTION ON CONTACTOR	10 - 32	

NOTES

1. THIS LEAD TO BE AS SHORT AS PRACTICAL. FOR GOOD RESULTS NOT TO EXCEED FIVE FEET.
2. LINKS TO BE IN POSITION SHOWN FOR OPERATING 12V. RELAY, AND BOTH IN DOTTED POSITION FOR 115V. RELAY.
3. REMOVE LINK IF REMOTE RADIO PHONE UNIT TYPE-23071 OR -23072 IS CONNECTED.
4. THESE LEADS ARE TO BE RUN IN SEPERATE CONDUIT.
5. SIZE OF WIRE CALCULATED FOR MAXIMUM DISTANCE OF 500 FT. ALLOWING 3% DROP IN LINE VOLTAGE IN LEADS. IF DISTANCE FROM VOLTAGE SOURCE IS GREATER THAN 500 FT. ADVISE USE OF WIRE SIZE TO GIVE A 3% DROP IN LINE. MINIMUM ALLOWABLE VOLTAGE AT MOTOR TERMINAL IS NOMINAL LINE VOLTAGE MINUS 10%. USE E WIRE FOR 440/3/60, SUPPLY
6. TERMINALS SHOWN IN TRANSMITTER UNIT NOT MARKED WITH TERMINAL DESIGNATION SYMBOL ARE "BB" TERMINALS.
7. NAVY 4-- OR 6-- WIRE CONTROL UNITS NOT SUPPLIED ON CONTRACT AS PART OF EQUIPMENT. TYPE MHFA- WIRE FOR CONNECTION TO THESE TERMINALS SUPPLIED AS PART OF REMOTE CONTROL UNIT.
8. NAVY TYPE -23172, -23211, -23071, OR -23072 NOT SUPPLIED ON CONTRACT AS PART OF EQUIPMENT. CONNECTIONS TO TYPE -23172 OR -23211 SHOWN IN INSET. CONNECTIONS TO TYPE -23071 SHOWN ON DRAWING M-7414348 AND TO TYPE -23072 ON DRAWING M-7414347. TYPE MHFA - WIRE FOR CONNECTIONS TO THESE UNITS SUPPLIED AS PART OF REMOTE CONTROL EQUIPMENT AND NOT ON CONTRACT FOR TBM-11.
9. FOR 440/3/60 SUPPLY EQUIPMENT CONSISTS OF TRANSMITTER UNIT CAY-52171, MOD. UNIT CAY-50065-A M-G SET CAY-21677. & MAG. CONT. CAY-21233
10. BEFORE INITIAL OPERATION OF EQUIPMENT CONNECT CIRCUITS AS INDICATED IN CONNECTION TABLE FOR PARTICULAR TYPE OF POWER SUPPLY AND CONTROL CIRCUITS.
11. FRAME OF M-G SET AND CASE OF MAGNETIC CONTROLLER ARE TO BE BONDED TO TRANSMITTER FRAME BY G WIRE.

FIG. 41. INTERCONNECTION DIAGRAM, MODEL TBM-11 EQUIPMENT, A.C. OPERATION. (DWG. T-7613303)
7-41


TRANSMITTER UNIT
NAVY TYPE
CAY-52217 115V DC
CAY-52218 230V DC
TRANSMITTER TERMINALS
NAVY 4 WIRE CONTROL
TRANSMITTER TERMINALS
NAVY 6 WIRE CONTROL
MODULATOR UNIT
NAVY TYPE CAY-50085 A
MOTOR GENERATOR SET
TYPE CAY-21673 115V D C
TYPE CAY-21676 230V D C
MOTOR CAY-21678 115VDC CAY-21681 230VDC
H V GENERATOR CAY-21680
L V & BIAS GENERATOR CAY-21679
MAGNETIC CONTROLLER
TYPE CAY-21823 115VDC
TYPE CAY-21832 230VDC
RADIOPHONE REMOTE CONTROL UNIT
TYPE -23172 OR -23211
FOR 6-WIRE REMOTE CONTROL
INSTALL SWITCH S-17 ON FRONT PANEL AND CONNECT TO TERMINAL BOARD ON BACK OF FRONT PANEL DIRECTLY BELOW SWITCH AS SHOWN
FOR 4-WIRE REMOTE CONTROL
INSTALL SWITCH S-8 ON FRONT PANEL AND CONNECT TO TERMINAL BOARD ON BACK OF FRONT PANEL DIRECTLY BELOW SWITCH AS SHOWN
TO ANTENNA
ANTENNA STUD IN TOP OF UNIT
TO REMOTE KEY (SEE 4 OR 6 WIRE DIAGRAM ABOVE.)
TO RECEIVER ATTENUATOR RELAY
AUDIO LINE INPUT 600 OHMS
RECEIVER AUDIO OUTPUT 600 OHMS
TO MIC. PUSH BUTTON
+12V.
TO NAVY REMOTE CONTROL UNIT (SEE NOTE 7 & 8)
R F TO FREQ METER
AUDIO OUTPUT FROM FREQ METER
TO 115 OR 230 VOLT LINE

CONNECTION TABLE

CIRCUIT	115 VOLT CONNECTION 4-WIRE	115 VOLT CONNECTION 6-WIRE	230 VOLT CONNECTION 4-WIRE	230 VOLT CONNECTION 6-WIRE	SEE NOTE 10
S-18	OPEN	CLOSE	OPEN	CLOSE	
S-20	A TO C	A TO D	A TO B	A TO D	
S-21	H TO K	H TO J	H TO K	H TO J	
R-28	PARALLEL CONN. LINKS IN 115V. POS.		SERIES CONN. LINKS IN 230V. POS.		
T-1	1 TO 5 & 2 TO 6		2 TO 6		
R-27	DUMMY		USE R-7		
R-32	DUMMY		USE R-32		
R-34, R-35	USE R-35		USE R-34		
R-29 R-38	NOT USED. RESISTOR POSITIONS LEFT BLANK		USE R-29 & R-38 IN PROPER POSITIONS.		
S-8	6-8 CONNECT AS SHOWN	NOT USED	S-8 CONNECT AS SHOWN	NOT USED	
S-17	NOT USED	S-17 CONNECT AS SHOWN	NOT USED	S-17 CONNECT AS SHOWN	
T-408	1 TO 5 & 2 TO 8		1 TO 5 & 2 TO 6		
T-409	LINK 3 TO 2 CONNECT INPUT LEADS TO 5 AND 8		LINK 1 TO 3 AND 2 TO 4 LINK 5 TO 7 AND 8 TO 8 CONNECT INPUT LEADS TO 1 AND 4.		

ANTENNA DATA

MAXIMUM LENGTH OF ANTENNA	90 FT.
MAXIMUM LENGTH OF TRUNK	35 FT.
MINIMUM LENGTH OF TRUNK	NONE
DIAMETER OF TRUNK	8 TO 12 INCHES
MAXIMUM DISTANCE TO ENTERING INSULATOR	20 FT.
MINIMUM DISTANCE TO ENTERING INSULATOR	8 FT.
CAPACITY 500 TO 1000 MMFD.	RESISTANCE (R.F.) 8 TO 30 OHMS

POWER REQUIREMENTS

POWER SUPPLY	115 OR 230 V.D.C.	(SEE NOTE 9)
ALLOWABLE VARIATION IN LINE VOLTAGE	10%	
RATED H.P. OF MOTOR	5 AT 1800 R.P.M.	

CONDITION	LINE AMPERES 115V.	LINE AMPERES 230V.	KILOWATTS REQUIRED FROM LINE 115V.	KILOWATTS REQUIRED FROM LINE 230V.
STARTING	87	43	10	10
LOCKED KEY	37.4	18.7	4.3	4.3
STANDBY	23.5	12.2	2.7	2.8

WIRE LEGEND

SYMBOL	CONDUCTOR SIZE & BRAID AWG	ALLOWABLE DROP	CURRENT RATING	VOLTAGE RATING	TYPE INSULATION	COMMERCIAL DESIGNATION	NAVY DESIGNATION	NOTES
A	4,494		25	1000	ASBESTOS		SHFA 4	
B	4,494		25	5000	ASBESTOS		SHFR-4	
C	1,758		3	1500	SYN. RESIN		AN RG 12/U	
D	2,828		8	1000	MULTITEX		DNFA-3	
E_1	50,940	3% OF LINE VOLTAGE	160	1000	ASBESTOS		DNFA-60	5
E_2	14,350	3% OF LINE VOLTAGE	65	1000	ASBESTOS		DNFA 14	5
F	3/8" TO 1/2" DIA.				NONE			COPPER T.& B. NO
G	1"WIDE x 1/32" TK				NONE			SEE 11 COPPER STRAP PART OF ASSEMBLY
H								
J	2,828		8	1000	ASBESTOS		MWFA-	7 & 8

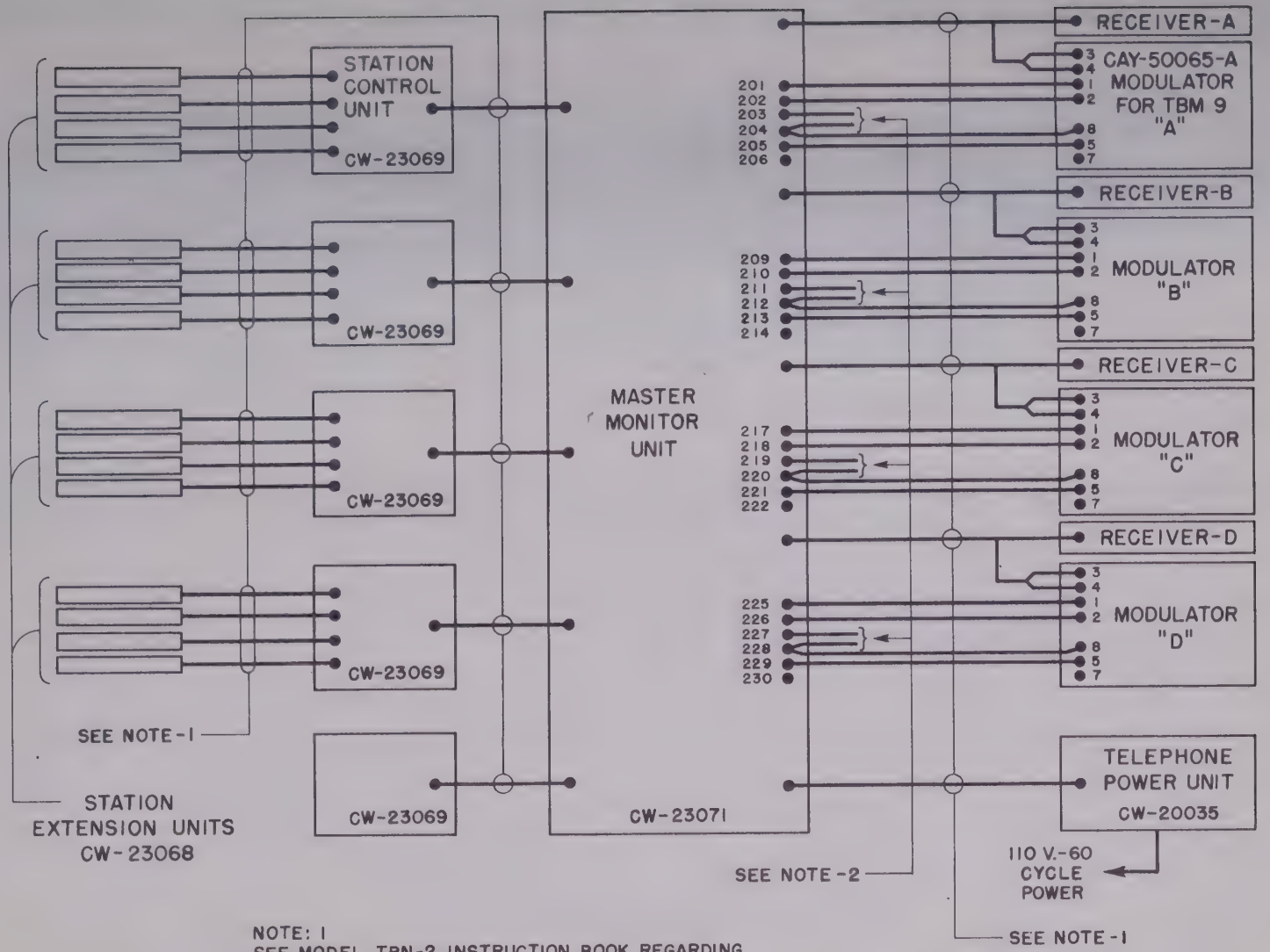
TERMINAL DESIGNATION

SYMBOL	DESCRIPTION	SIZE OF TERMINAL STUD OR SCREW	NOTES
AA	MOLDED TERMINAL STRIP	10 – 32	
BB	CERAMIC LEAD-THRU BUSHINGS IN LAMINATED PHENOLIC BOARD	10 – 32	6
CC	STUD ON STAND-OFF-INSULATOR IN TOP SECTION OF TRANSMITTER	1/4 – 20	
DD	SCREW IN EAR ON FUSE CLIP	10 – 32	
EE	STUD IN LAMINATED PHENOLIC BOARD	10 – 32	
FF	SCREW IN CONNECTION STRAP	1/4 – 20	
GG	STUD IN LAMINATED PHENOLIC BOARD	1/4 – 20	
HH	CONNECTION STUD ON CONTACTOR	1/4 – 20	

NOTES

1. THIS LEAD TO BE AS SHORT AS PRACTICAL. FOR 6000 RESULTS NOT TO EXCEED FIVE FEET.
2. LINKS TO BE IN POSITION SHOWN FOR OPERATING 12V. RELAY, AND BOTH IN DOTTED POSITION FOR 115V. RELAY.
3. REMOVE LINK IF REMOTE RADIO PHONE UNIT TYPE-23071 OR -23072 IS CONNECTED.
4. THESE LEADS ARE TO BE RUN IN SEPERATE CONDUIT.
5. SIZE OF WIRE CALCULATED FOR MAXIMUM DISTANCE OF 400 FT. ALLOWING 3% DROP IN LINE VOLTAGE IN LEADS. IF DISTANCE FROM VOLTAGE SOURCE IS GREATER THAN 400 FT. ADVISE USE OF WIRE SIZE TO GIVE A 3% DROP IN LINE. MINIMUM ALLOWABLE VOLTAGE AT MOTOR TERMINALS IS NOMINAL LINE VOLTAGE MINUS 10%. USE E_1 WIRE FOR 115 V.D.C. SUPPLY AND E_2 WIRE FOR 230 V.D.C. SUPPLY.
6. TERMINALS SHOWN IN TRANSMITTER UNIT NOT MARKED WITH TERMINAL DESIGNATION SYMBOL ARE "BB" TERMINALS.
7. NAVY 4— OR 6— WIRE CONTROL UNITS NOT SUPPLIED ON CONTRACT AS PART OF EQUIPMENT. TYPE WMFA- WIRE FOR CONNECTION TO THESE TERMINALS SUPPLIED AS PART OF REMOTE CONTROL UNIT.
8. NAVY TYPE -23172, -23211, -23071, OR -23072 NOT SUPPLIED ON CONTRACT AS PART OF EQUIPMENT. CONNECTIONS TO TYPE -23172 OR -23211 SHOWN IN INSET. CONNECTIONS TO TYPE -23071 SHOWN ON DRAWING W-7414346 AND TO TYPE -23072 ON DRAWING W-7414347. TYPE WMFA – WIRE FOR CONNECTIONS TO THESE UNITS SUPPLIED AS PART OF REMOTE CONTROL EQUIPMENT AND NOT ON CONTRACT FOR TBM-11
9. FOR 115v. D.C. SUPPLY EQUIPMENT CONSISTS OF TRANSMITTER UNIT CAY-52217, MODULATOR UNIT CAY-50085-A, MOTOR GENERATOR SET CAY-21673, AND MAGNETIC CONTROLLER CAY-211231.
   FOR 230 V.D.C. SUPPLY EQUIPMENT CONSISTS OF TRANSMITTER UNIT CAY-52218, MODULATOR UNIT CAY-50085-A, MOTOR GENERATOR SET CAY-21676. AND MAGNETIC CONTROLLER CAY-211232.
10. BEFORE INITIAL OPERATION OF EQUIPMENT CONNECT CIRCUITS AS INDICATED IN CONNECTION TABLE FOR PARTICULAR TYPE OF POWER AND CONTROL CIRCUITS.
11. FRAME OF M-G SET AND CASE OF MAGNETIC CONTROLLER ARE TO BE BONDED TO TRANSMITTER FRAME BY G WIRE.

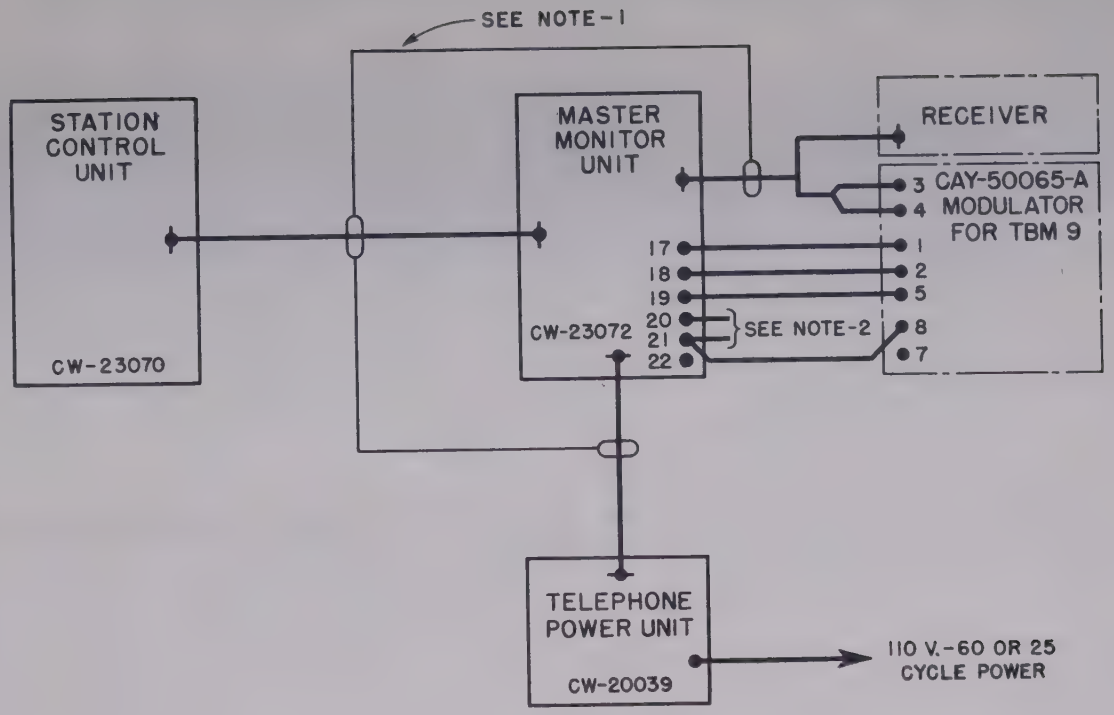
FIG. 42. INTERCONNECTION DIAGRAM, MODEL TBM-11 D.C. OPERATION.
(DWG. T-7613302)



NOTE: 1
SEE MODEL TBN-2 INSTRUCTION BOOK REGARDING OTHER CONNECTIONS TO THE MASTER MONITOR.

NOTE: 2
CONNECT TO TRANSMITTER KEY RELAY AUXILIARY CONTACTS FOR CONTROL OF RECEIVER RELAY.

FIG. 43. INTERCONNECTION DIAGRAM, MODEL TBM-11 EQUIPMENT, WITH NAVY TYPE CW-23071 MASTER MONITOR. (Dwg. M-7414346)



NOTE: 1
SEE MODEL TBN-3 INSTRUCTION BOOK REGARDING OTHER CONNECTIONS TO THE MASTER MONITOR.

NOTE: 2
CONNECTION TO TRANSMITTER KEY RELAY AUXILIARY CONTACTS FOR CONTROL OF RECEIVER RELAY.

FIG. 44. INTERCONNECTION DIAGRAM, MODEL TBM-11 EQUIPMENT, WITH NAVY TYPE CW-23072 MASTER MONITOR. (Dwg. M-7414347)

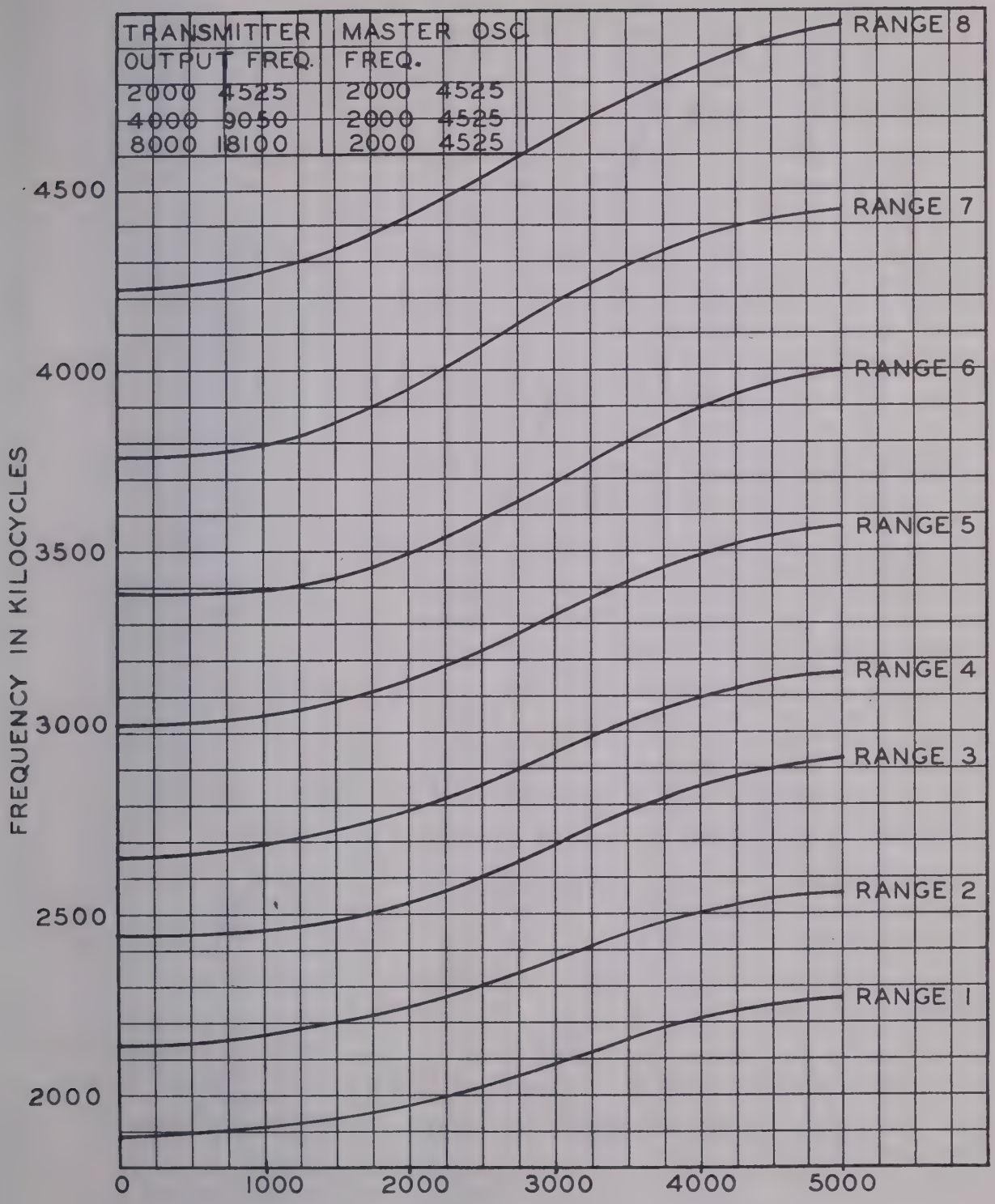


FIG. 45. TUNING CURVE FOR MASTER OSCILLATOR, CONTROLS A AND B CURVE #226373.

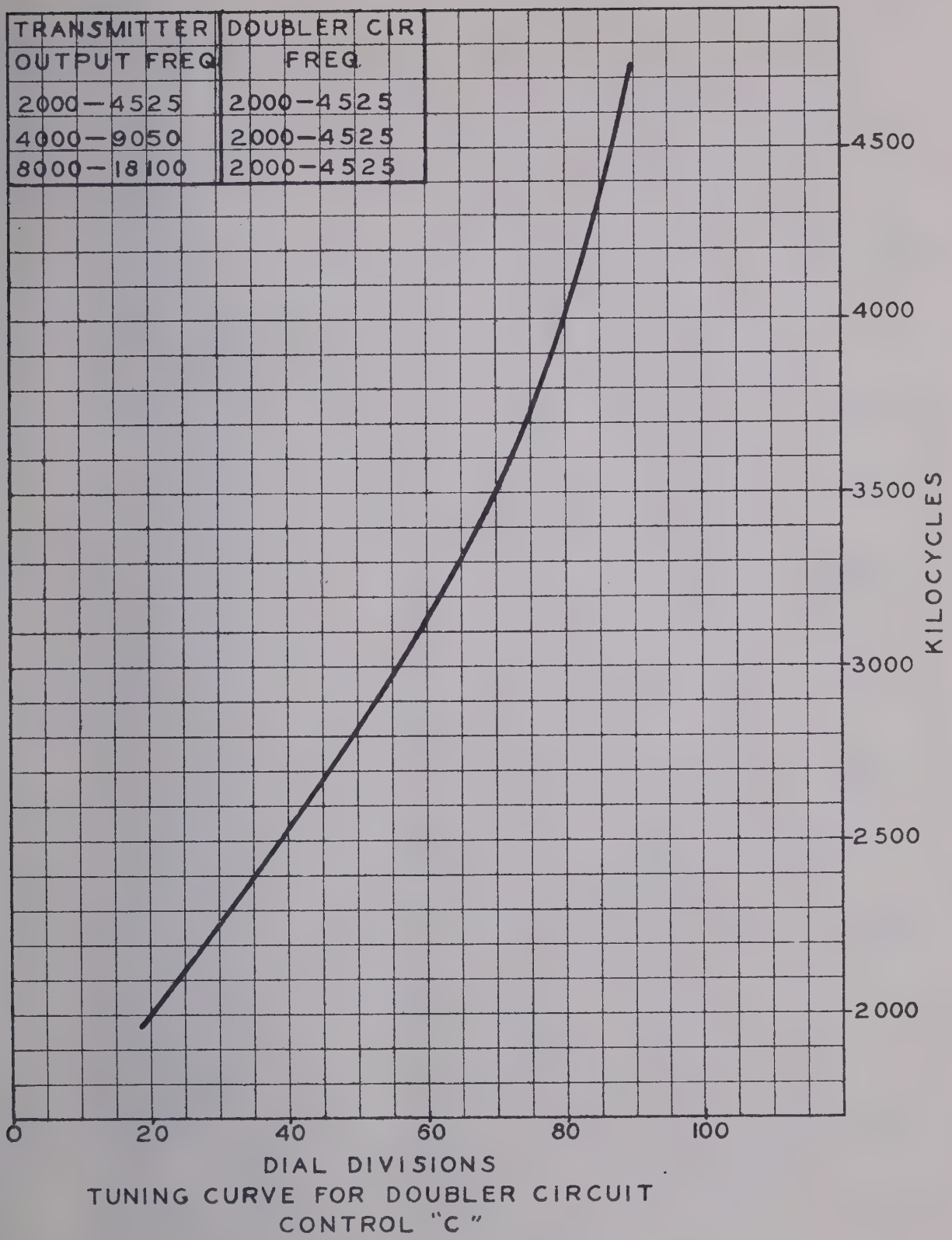


FIG. 46. TUNING CURVE FOR DOUBLER CIRCUIT - CONTROL C CURVE #218634.

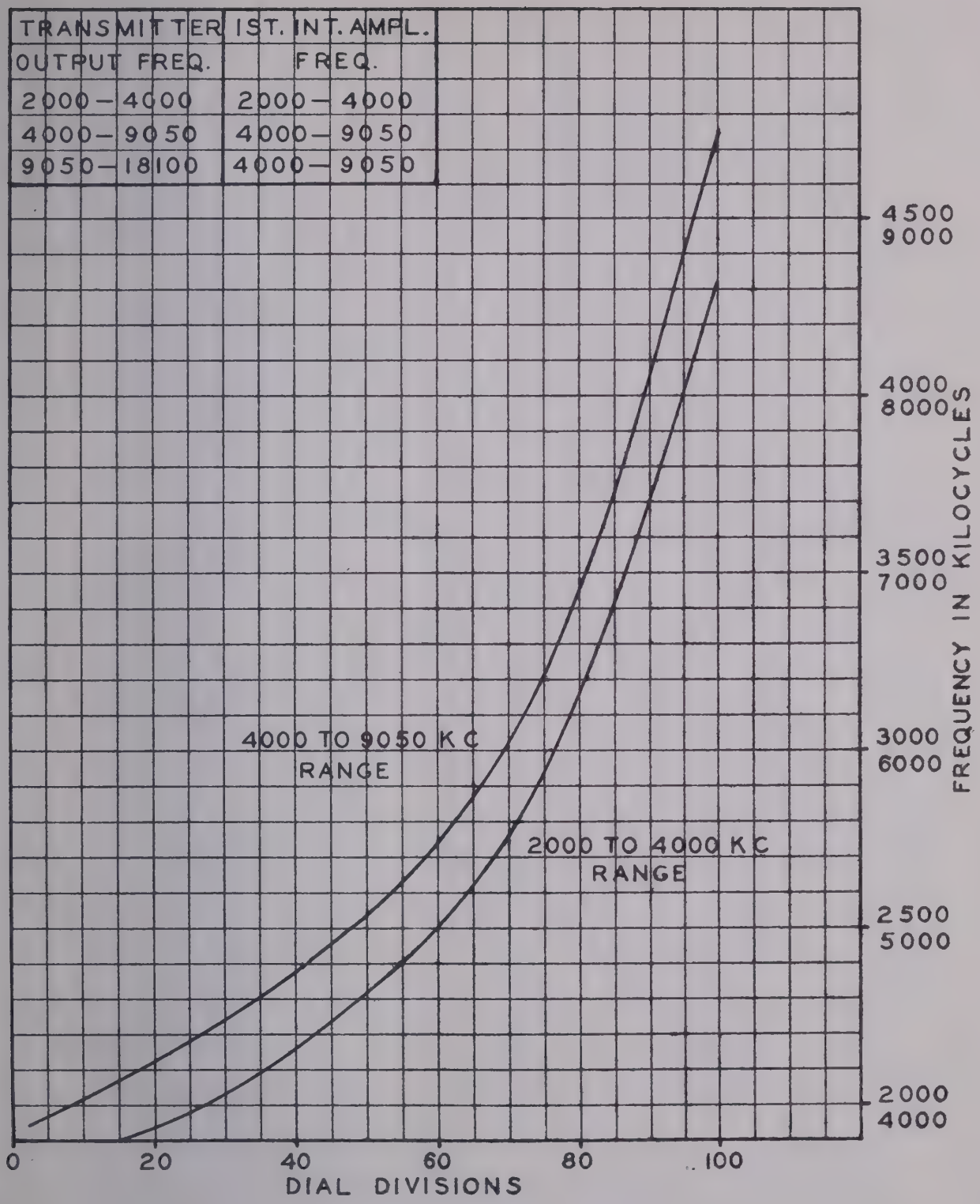


FIG. 47. TUNING CURVE FOR FIRST INTERMEDIATE AMPLIFIER CONTROL D. CURVE #218636.

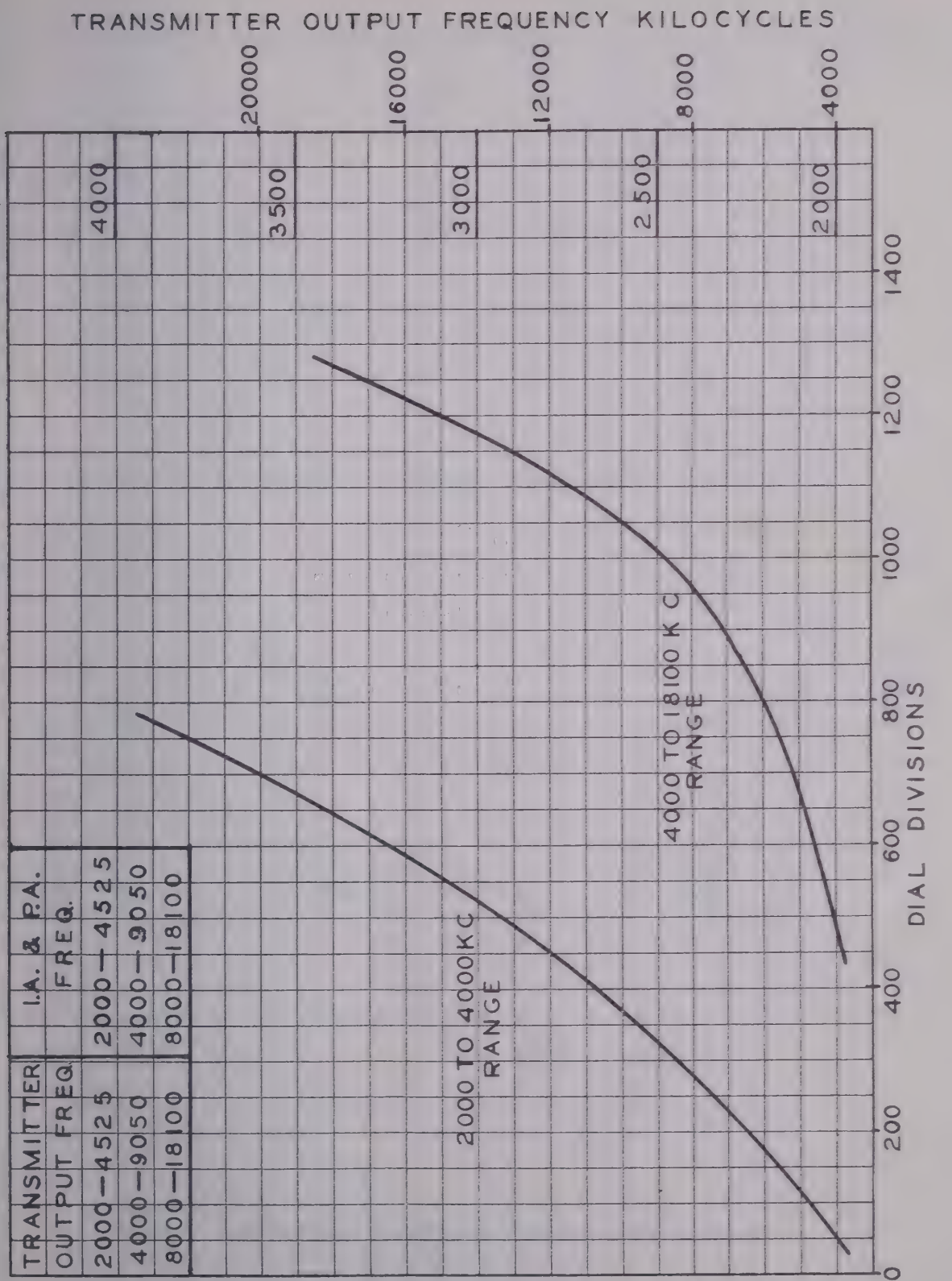
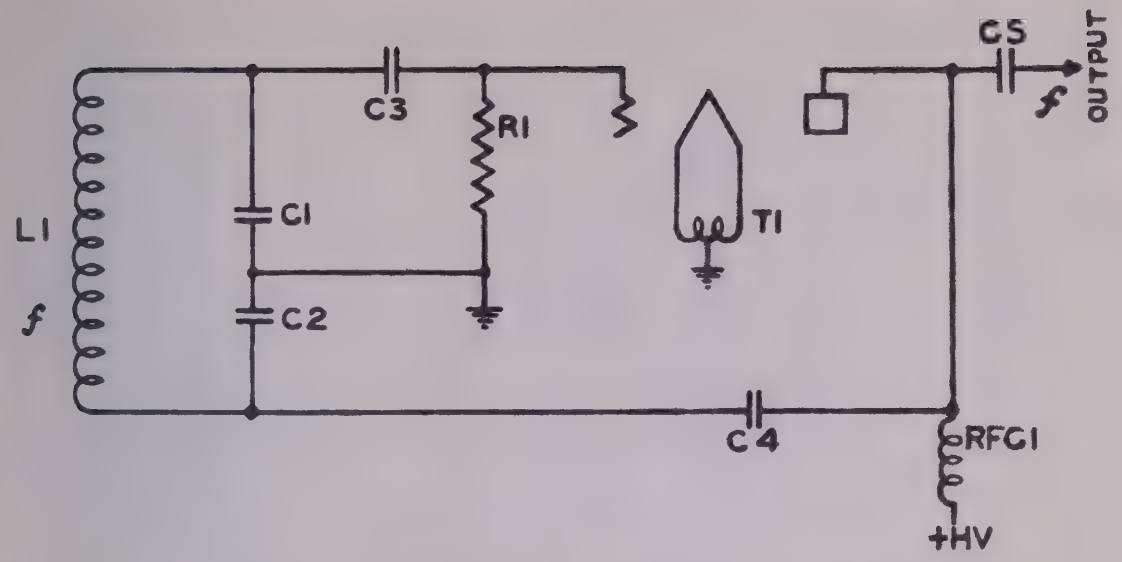
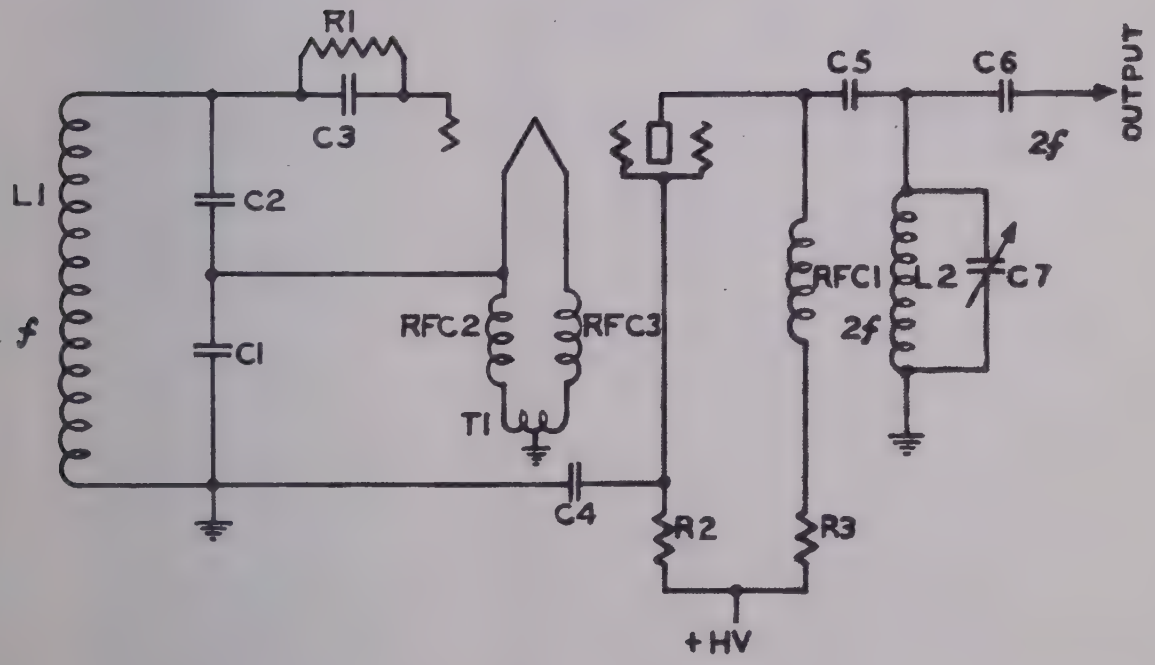


FIG. 48. TUNING CURVE FOR SECOND INTERMEDIATE AMPLIFIER AND POWER AMPLIFIER - CONTROLS E AND F CURVE #218635.

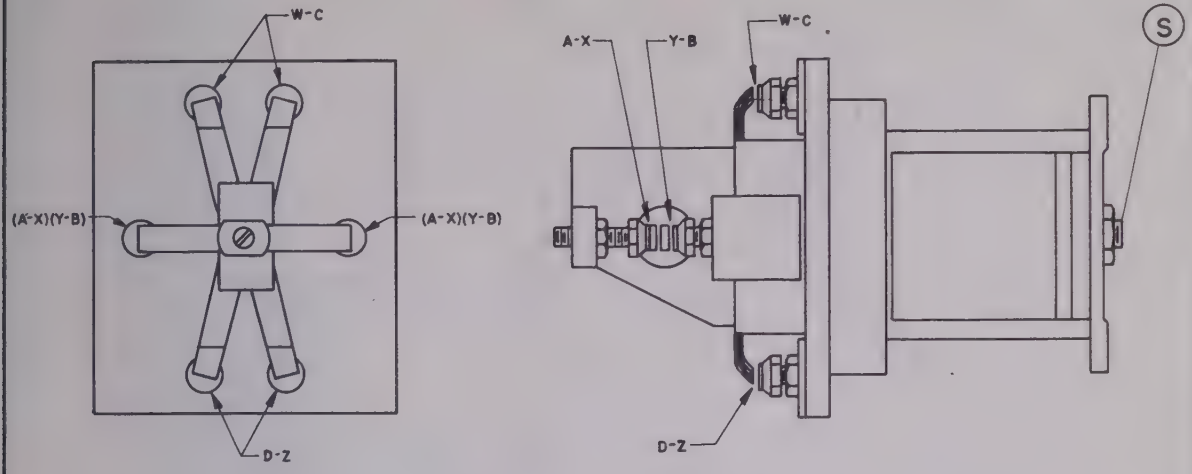


STANDARD COLPITTS OSCILLATOR CIRCUIT



ELECTRON COUPLED OSCILLATOR CIRCUIT

FIG. 49. STANDARD COLPITTS OSCILLATOR CIRCUIT AND ELECTRON COUPLED OSCILLATOR CIRCUIT. (Dwg. P-7705422)



CAUTION: MAKE ALL ADJUSTMENTS BY RAISING OR LOWERING STATIONARY CONTACT STUDS. DO NOT BEND SPRING CONTACTS. A PIECE OF CROCUS CLOTH SLID BETWEEN SPRING AND STUD WILL CLEAN CONTACTS.

ADJUSTMENT PROCEDURE:

1. PRESS PLUNGER DOWN UNTIL IT BOTTOMS ON STUD. RAISE STUD (S) UNTIL BOTTOM OF INSULATOR IS .375" FROM TOP OF HEX. SHOULDER ON GUIDE PINS. (SEE NOTE BELOW)

2. RAISE PLUNGER .009 INCHES FROM BOTTOM POSITION AND ADJUST CONTACTS (W-C) TO JUST MAKE CONTACT.

3. RAISE PLUNGER AN ADDITIONAL .001 INCHES MAKING A TOTAL OF .010 INCHES FROM BOTTOM AND ADJUST CONTACTS (D-Z), (Y-B), AND (A-X) TO JUST MAKE CONTACT.

4. FINAL ADJUSTMENT IS TO BE MADE BY OBSERVING KEYING WAVE FORM ON OSCILLOGRAPH. THE CONTACTS SHALL CLOSE RELIABLY AND THERE SHALL BE NO CHATTER. REMOVE ANY SLIGHT BREAK BY SLIGHT ADJUSTMENT OF STUD (S). RELAYS WITH PLUNGERS THAT STRIKE BOTTOM ARE CONSIDERED SATISFACTORY, PROVIDED ALL OTHER REQUIREMENTS ARE MET.

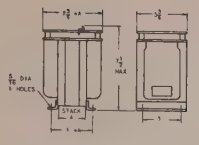
   NOTE: ON OLD MODELS WHERE ADJUSTABLE STUDS (S) WERE NOT PROVIDED, STRETCHING SPRINGS (DWG. 7604741, PT.15) IS PERMISSABLE TO REMOVE BOUNCE. WHEN ADJUSTING THESE, OMIT STEP 1.

5. AFTER ADJUSTMENT, CHECK ALL LOCKNUTS AND MAKE CERTAIN THEY ARE TIGHT BEFORE REASSEMBLY OF RELAY IN EQUIPMENT.

FIG. 50. KEYING RELAY CONTACT ADJUSTMENT. (Dwg. P-7711743)

PART 1
200 IN OF .064 DIA. #14 TINNED COPPER WIRE
TAPS AT 1, 3, 17 + 19
24 TURNS
7 TURNS PER INCH.
PART 2
TOP WINDING 48 TURNS 580 IN LG. .0641 DIA #14 S.C.C.EN. WIRE
BOTTOM WINDING 50 TURNS 300 IN LG. .0641 DIA #14 S.C.C.EN. WIRE
TREATMENT 2 COATS AIR DRY VARNISH
INSULATOR
NAVY TYPE 6106!
(#10) .190-32 THD
PART 3
INDUCTANCE 0.076 M.H. MIN. 0.092 MAX.
85 TURNS #24 D.C.C. EN.
INDUCTANCE 4MM. D.C. RES. 10 OHMS
PART 4
TAP AT 3RD FULL TURN
16 TURNS
220 IN TINNED COPPER WIRE .102 DIA.
APPLY 1 COAT, DIPPED, AIR DRY VARNISH
PART 5
PTS-A = 1 7/8 IN, B = 1 IN.
PT 7-A = 2 1/16 IN, B = 1 IN.
PART 6
125 TURNS #24 D.C.C.EN.
INDUCTANCE .35MH., DC. RES. 1.35 OHMS
PART 7
INDUCTANCE 4 MM., D.C. RES. 3.15 OHMS
373 TURNS 24 D.C.C.EN.
FOR PART 9
FOR PART 10
PART 8
PART 9
14 TVENS 3/16 x 5/16 COPPER BAR WOUND EDGEWISE
5-T
10-T
10-T
5-T
INSULATOR
NAVY TYPE 6113
PART 13
240 IN OF .010 DIA. D.C.C. COPPER WIRE SPACED 1 DIA.
INSULATOR
NAVY TYPE 6113
PART 11
480 IN OF .059 DIA. S.C.C.EN.C. WIRE
PART 14
5 TURNS OF #10 (.102) DIA.
TINNED COPPER WIRE
18 TURNS OF COPPER STRAP 1/2 X 1/16 TK. EDGEWISE WOUND
PART 12

FIG. 51. TRANSMITTER, DIMENSIONAL DRAWINGS AND WINDING DATA OF TUNING COILS AND VARIOMETERS. (Dwg. T-7607966)



PART 1 L-317199 A=3 IN

WDG	TAPS	VOLTS	AMPS	TURNS	RESIS. ±15%	WIRE
P 1	1 TO 2	220	0.63	320	8.5 OHMS	#26 S.C.C.E
P 2	3 TO 4	220	0.63	320	10 OHMS	#26 S.C.C.E
S 1	5 TO 6	115	1.1	168	1.3 OHMS	#20 S.C.C.E
S 2	7 TO 8	110	1.1	168	1.7 OHMS	#20 S.C.C.E

TEST 2000 VOLTS

PART 2 L-317135 A=3 IN

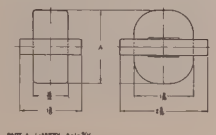
WDG	TAPS	VOLTS	AMPS	TURNS	RESIS ±15%	WIRE
P 1	1 TO 2	220	0.8	240	4.0 OHMS	#22 S.C.C.E
P 2	3 TO 4	220	0.8	240	5.6 OHMS	#22 S.C.C.E
S 1	5 TO 6	110	1.5	125	1.65 OHMS	#20 S.C.C.E
S 2	7 TO 8	110	1.5	125	2.0 OHMS	#20 S.C.C.E

TEST 2000 VOLTS

PART 3 L-317136 A=4 IN

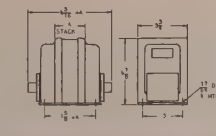
WDG	TAPS	VOLTS	AMPS	TURNS	RESIS ±15%	WIRE
P 1	4 TO 6	100	1.18	113	1.2 OHMS	#20 S.C.C.E
P 1	5 TO 6	70	1.70	79	1.0 OHMS	#20 S.C.C.E
P 2	1 TO 3	100	1.18	113	1.2 OHMS	#20 S.C.C.E
P 2	2 TO 3	70	1.70	79	1.0 OHMS	#20 S.C.C.E
S 1	7 TO 8	6.3	10	7	.018 OHM	#12 ENAM.
S 1	7 TO 9	11.3	10	13.5	.032 OHM	#12 ENAM.
S 2	137018	5	6.5	6	.025 OHM	#16 ENAM.
S 2	137019	10	6.3	12	.05 OHM	#16 ENAM.
S 3	107011	3.5	3.25	6.5	.04 OHM	#16 ENAM.
S 3	107017	11	3.25	13	.08 OHM	#16 ENAM.

TEST 2500 VOLTS



PART 4 L-332701 A=1-9/16

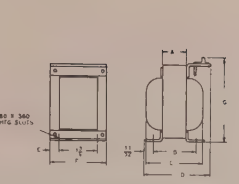
1.5 WATT, 60 CYCLE
PRIMARY-105V., 0.012 AMPS., 4160 TURNS, 675 OHMS
SECONDARY-0.52V., 10 AMPS., 10 TURNS, 0.008 OHMS
TEST 1500 VOLTS



PART 5 L-332702 A = 3/4 IN

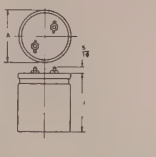
WDG	TAPS	VOLTS	VOLTS	TURNS	RESIS ±15%	WIRE
P 1	1 TO 2	100	0.1	360	16 OHMS	#26 ENAM.
P 2	3 TO 4	100	0.1	360	17 OHMS	#26 ENAM.
SINGLE	5 TO 6	6.3	2.25	33	.049 OHM	#18 ENAM.
SEC	5 TO 7	11	7.25	68	.085 OHM	#18 ENAM.

TEST 1500 VOLTS



PART 6 L-388518 A = 1 3/16, B=2, C = 2 5/8, D = 3 1/16, E = 2 7/8, F = 2 1/2, G = 3 5/32

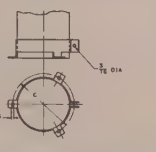
500 TURNS, TAPPED AT 200, 0.19 HENRIES AT 67 V., 60 CYCLES, D.C. RESISTANCE 3.3 OHMS, TEST 1500 VOLTS BETWEEN WINDINGS AND CORE OVER-POTENTIAL TEST OF 2100 V., 800 CYCLES



PART 7 L-365787 A = 2 1/2, B = 3 5/16

WDG	TAPS	VOLTS	AMPS	TURNS	RESIS ±15%	WIRE
PRI	1 TO 2		0.21	1100	1.2 OHMS	#28 S.C.C.E
S 1	3 TO 2		0.004 S	2800	1950 OHMS	#42 ENAM.
S 2	2 TO 4		0.004 S	2800	2000 OHMS	#42 ENAM.

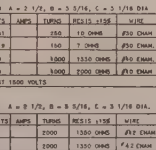
INDUCTANCE 22 MH MIN



PART 8 L-365786 A = 2 1/2, B = 3 5/16, C = 3 1/16 DIA

WDG	TAPS	VOLTS	AMPS	TURNS	RESIS ±15%	WIRE
PRI	1 TO 2	110		800	5.8 OHMS	#26 ENAM.
SEC	3 TO 4	3.2		1280	.62 OHMS	#30 ENAM.

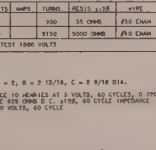
TEST 1200 VOLTS



PART 9 L-365750 A = 2 1/2, B = 3 5/16, C = 3 1/16 DIA

WDG	TAPS	VOLTS	AMPS	TURNS	RESIS ±15%	WIRE
P 1	5 TO 6	0.31		250	10 OHMS	#30 ENAM
P 1	4 TO 6	0.19		150	7 OHMS	#30 ENAM.
S 1	1 TO 2	5.0		1000	1330 OHMS	#40 ENAM.
S 2	2 TO 3	5.0		1000	2200 OHMS	#40 ENAM

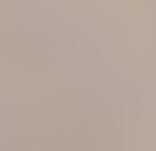
TEST 1500 VOLTS



PART 10 L-365749 A = 2 1/2, B = 3 5/16, C = 3 1/16 DIA.

WDG	TAPS	VOLTS	AMPS	TURNS	RESIS ±15%	WIRE
P 1	1 TO 2	9		2000	1380 OHMS	#42 ENAM.
P 2	2 TO 3	9		2000	1350 OHMS	#42 ENAM.
S1 & S2	7 TO 8	5.5		1150	105 OHMS	#34 ENAM.
S 2	5 TO 6	15		3000	2500 OHMS	#32 ENAM.
S 1	4 TO 5	15		3000	2500 OHMS	#32 ENAM.

TEST 1500 VOLTS



PART 11 L-365778 A = 2 1/2, B = 3 5/16, C = 3 1/16 DIA

WDG	TAPS	VOLTS	AMPS	TURNS	RESIS ±15%	WIRE
P 1	1 TO 2	5		900	35 OHMS	#30 ENAM
S 1	3 TO 4	50		9150	5000 OHMS	#40 ENAM

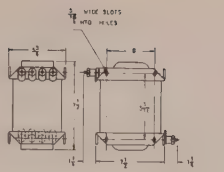
TEST 1500 VOLTS

PART 12 L-365781 A = 2, B = 2 13/16, C = 2 9/16 DIA.

3100 TURNS, INDUCTANCE 10 HENRIES AT 3 VOLTS, 60 CYCLES, 0.070 AMP. D.C., RESISTANCE 829 OHMS D.C. ±15%, 60 CYCLE IMPEDANCE 3750 OHMS, TEST 1500 VOLTS, 60 CYCLE

PART 13 L-365782 A = 2, B = 2 3/16, C = 2 9/16 DIA.

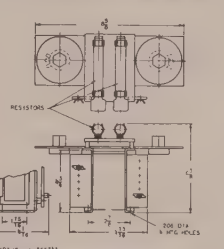
2000 TURNS, INDUCTANCE 1.8 HENRIES AT 3.0 VOLTS, 1000 CYCLES, 0 AMP. D.C., RESISTANCE 190 OHMS D.C. ±15%, 60 CYCLE IMPEDANCE 800 OHMS, TEST 1500 VOLTS, 60 CYCLE.



PART 14 L-365782

WDG	TAPS	VOLTS	AMPS	TURNS	RESIS. ±15%	WIRE
P1 & P2	1 TO 2	1330	0.35	800	50 OHMS	#26 S.C.C.E
P2 & P3	3 TO 4	1330	0.35	800	50 OHMS	#26 S.C.C.E
S1 & S2	5 TO 6	253	0.21	321	10 OHMS	#26 S.C.C.E
S1 & S2	6 TO 7	28	0.21	21	1 OHM	#26 S.C.C.E
S1 & S2	7 TO 8	1680	0.21	1218	62 OHMS	#26 S.C.C.E

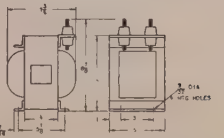
TEST 6000 VOLTS



PART 15 L-365784

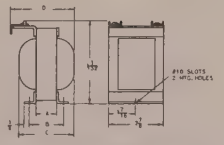
WDG	TAPS	VOLTS	AMPS	TURNS	RESIS ±15%	WIRE
P 1	1 TO 2	127		750	50.5 OHMS	#29 S.C.C.E
P 2	2 TO 3	127		750	50.5 OHMS	#29 S.C.C.E
S 1	8 TO 10	62		375	25.5 OHMS	#29 S.C.C.E
	10TO11	85		575	75.5 OHMS	#29 S.C.C.E
S 2	6 TO 7	38		270	15.0 OHMS	#29 S.C.C.E
	7 TO 8	33		220	19.8 OHMS	#29 S.C.C.E
S 3	4 TO 5	10		80	4.1 OHMS	#29 S.C.C.E

TEST 1500 VOLTS



PART 16 L-365761

3000 TURNS, INDUCTANCE 15 HENRIES AT 110 VOLTS, 60 CYCLE, 0.27 AMP. D.C., RESISTANCE 105 OHMS D.C. ±15%, 60 CYCLE IMPEDANCE 15206 OHMS, TEST 10,000 VOLTS, 60 CYCLE

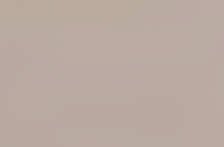


PART 17 L-365787 A = 1 7/8, B = 1 5/8, C = 1 1/8, D = 3 1/32

210 TURNS, INDUCTANCE 0.067 HENRY AT 3 VOLTS, 60 CYCLE, 0.56 AMP D.C., RESISTANCE 0.35 OHM D.C. ±15%, 60 CYCLE IMPEDANCE 25 OHMS, TEST 1500 VOLTS, 60 CYCLES

PART 18 L-365733 A=2, B=2 3/4, C=3 3/4 D=4 3/4

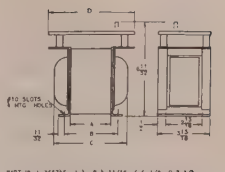
3600 TURNS, INDUCTANCE 30 HENRIES AT 100 VOLTS, 60 CYCLE AT 0 AMPS D.C., RESISTANCE 23 OHMS D.C. ±15%, 60 CYCLE IMPEDANCE 11300 OHMS, TEST 1500 VOLTS, 60 CYCLE



PART 19 L-365795 A=3, B=4-11/16, C=4-1/8, D=7-1/2

WDG	TAPS	VOLTS	AMPS	TURNS	RESIS ±15%	WIRE
P1	4 TO 5	30	1.0	33	0.8 OHM	#22 S.C.C.E
	5 TO 6	70	1.0	79	1.8 OHMS	#22 S.C.C.E
P 2	1 TO 2	70	1.6	78	1.8 OHMS	#22 S.C.C.E
	2 TO 3	30	1.0	33	0.8 OHM	#22 S.C.C.E
S 1	7 TO 8	1	1.2	1	0.01 OHM	#18 ENAM
	8 TO 9	10	1.2	10.5	0.10 OHM	#18 ENAM
	8 TO 10	2.5	1.2	2.5	0.02 OHM	#18 ENAM
S 2	107011	2	1.2	2	0.02 OHM	#18 ENAM
	137018	6.5	10	7.5	0.015 OHM	#12 ENAM
	137019	4	10	4.5	0.009 OHM	#12 ENAM
	137023	9.2	10	6	0.012 OHM	#12 ENAM.
S 3	207021	1.2	5	1	0.008 OHM	#16 ENAM
	217022	1.35	5	2	0.009 OHM	#16 ENAM
S 4	117018	3.2	3.5	4.0	0.022 OHM	#18 ENAM
	187019	3.2	3.2	3.5	0.026 OHM	#18 ENAM
S 5	187016	25	0.3	28	0.55 OHM	#22 S.C.C.E

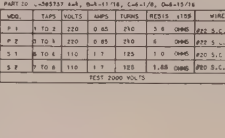
TEST 2000 VOLTS



PART 20 L-365737 A=3, B=4-11/16, C=4-1/8, D=8-15/16

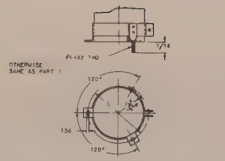
WDG.	TAPS	VOLTS	AMPS	TURNS	RESIS ±15%	WIRE
P 1	1 TO 2	220	0.65	290	3.8 OHMS	#22 S.C.C.E
P 2	3 TO 4	220	0.85	290	4 OHMS	#22 S.C.C.E
S 1	5 TO 6	110	1.7	125	1.0 OHMS	#20 S.C.C.E
S F	7 TO 8	110	1.7	125	1.88 OHMS	#20 S.C.C.E

TEST 2000 VOLTS



PART 21 L-365784 A=2, B=2-13/16, C=2-9/16 DIA

500 TURNS, INDUCTANCE 60 MILLIHENRIES AT 3 VOLTS, 60 CYCLE, 0.18 AMP. D.C., RESISTANCE 11 OHMS D.C. ±15%, 60 CYCLE IMPEDANCE 23 OHM., TEST 1500 VOLTS, 60 CYCLE



PART 22 L-269718

1600 TURNS, INDUCTANCE AT 110 VOLTS, 60 CYCLE AND 0.5 AMP D.C., 1 HENRY MIN., D.C. RESISTANCE 10 Ω OHMS MAX 50.0 OHMS MIN., 60 CYCLE IMPEDANCE 377 OHMS MIN., TEST AT 1500 VOLTS A.C.

FIG. 52. TRANSMITTER, DIMENSIONAL DRAWINGS AND WINDING DATA OF TRANSFORMERS AND REACTORS. (Dwg. T-7607964 and T-7607965)

DIMENSIONS IN INCHES

STANDARD TOLERANCE UNLESS OTHERWISE MARKED		
DECIMALS	FRACTIONS	FORMULA
OF TO ½"	± 1/64"	± .005"
OVER ½" TO 2"	± 1/32"	± .010"
OVER 2" TO 10"	± 1/16"	± .020"
ABOVE 10"	± 1/8"	± .030"

NOTES

*1 - THIS TRANSFORMER IS PART OF MODULATION METER DWG. 7605397-PT. 20.

*2 - THIS REACTOR IS RATED AT .16 H., 1.0 AMP., 6.1 OHMS AT 60 VOLTS A.C. 60~.

FIG. 1

FIG. 2
OTHERWISE SAME AS FIG 1

FIG. 5

FIG. 9

FIG. 10

FIG. 3

FIG 4

FIG. 8

FIG. 6

FIG. 7

FIG 11
OTHERWISE SAME AS FIG 1

TO BE CHANGED BY MATERIALS & STANDARDS SECTION ONLY

H	F	E	D	C	B	A	NO. OF TERMINALS	NAVY ≠ TYPE	L-SPEC	FIG.	PART	DESCRIPTION	SEE NOTE
											19		
			3 1/32	2 1/4	1 5/8	7/8	2		L-372113	7	18	REACTOR (MICROPHONE)	
			7/8 DIA	6 5/8	6 11/16	G	22		L-372118	10	17	TRANSFORMER (FILAMENT)	
							2	CAT-30518	L 365771	9	16	REACTOR	*
7/16 DIA	.156 DIA	3 1/4	5/16	9 5/8	2 1/2		4		L-365779	2	15	TRANSFORMER (VOICE RELAY)	
		7 1/2	6 5/8	4 11/16			22		L-365745	8	14	TRANSFORMER (FILAMENT)	
		4 5/32	3 1/4	2 3/4			2		L-365753	7	13	REACTOR (SCREEN GRID MOD.)	
		3 1/32	2 1/4	1 5/8	7/8		2		L-365747	7	12	REACTOR (MICROPHONE)	
		17 1/2	5 5/8			4	2		L-365743	6	11	REACTOR (MODULATION)	
							11		L-365744	5	10	TRANSFORMER (DRIVER)	
							8		L-365742	4	9	TRANSFORMER (MODULATION)	
	3/16	.156	2 3/8	5/16	2 3/16		4		L-365754	11	8	CHOKE (MOD GRID)	
	3/16	.156	2 3/4	5/16	2 13/16		2		L-365751	2	7	REACTOR (VOICE RELAY FILTER)	
	3/16	.156	3 1/16	5/16	3 5/16	2 1/2	9		L-365749	2	6	TRANSFORMER (INTERSTAGE)	
	3/16	.156	3 1/16	5/16	3 1/16	2 1/2	7		L-365750	2	5	TRANSFORMER (INPUT)	
	3/16	.156	2 3/4	5/16	2 3/4	2	4		L-365752	2	4	TRANSFORMER (CRYSTAL-TYPE OSCIL)	
	3/16	.156	2 3/4	5/16	2 13/16	2	4		L-365755	2	3	TRANSFORMER (VOICE RELAY)	
	3/16	.156 DIA	3 1/16	5/16	3 1/16	2 1/2	4		L-365748	2	2	TRANSFORMER (MIC TO LINE)	
				5/16	3 5/16	2 1/2	4		L-365741	1	1	TRANSFORMER (CURRENT)	1

FIG. 53. MODULATOR, DIMENSIONAL DRAWINGS AND WINDING DATA OF TRANSFORMERS AND REACTORS. (Dwg. T-7606307) 7-53

CONTACTOR AND RELAY OPERATING TABLE
FOR TRANSMITTERS TYPE CAY-52171, CAY-52217 AND CAY-52218

FIG. 54

RELAY OR CONTACTOR NUMBER	NAME	OIL FILLED	TRIP CURRENT	NORMAL OPERATION	REMARKS
K- 1	Keying	No	.....	100 M.A.	
K- 2	Compensator	No	.....	10 M.A.	
K- 4	Starting	No	.....	*	115-230 V.D.C. only
K- 5	H.V. Overload	No	*	.....	Instantaneous
K- 7	M.O. Overload	No	*	.....	Instantaneous
K- 8	Thermostat	No	.....	10 M.A.	440 V. 3 phase 60 cy. only
K- 9	Field	No	.....	*	115-230 V.D.C. only
K-14	Starting	No	.....	*	440 V. 3 phase 60 cy. only
K-19	Field	No	.....	*	440 V. 3 phase 60 cy. only
K-20	Thermostat	No	.....	10 M.A.	115-230 V.D.C. only

*To be filled in later.

CONTACTOR AND RELAY OPERATING TABLE
FOR MAGNETIC CONTROLLERS TYPES CAY-211231, CAY-211232, CAY-211233

FIG. 55

RELAY OR CONTACTOR NUMBER	NAME	OIL FILLED	TRIP CURRENT	NORMAL OPERATION	REMARKS
K-861	Contactor	No	.....	*	440 V. 3 phase 60 cy. only
K-862	Overload Relay	No	8.4 Amp.	.....	440 V. 3 phase 60 cy. only
K-851	Contactor	No	.....	*	230 V.D.C. only
K-852	Accelerating Contactor Main Coil	No	.....	*	230 V.D.C. only
	Accelerating Contactor Holding Coil	No	.....	*	230 V.D.C. only
K-853	Accelerating Contactor Main Coil	No	.....	*	230 V.D.C. only
	Accelerating Contactor Holding Coil	No	.....	*	230 V.D.C. only
K-854	Overload Relay	No	*	.....	230 V.D.C. only
K-841	Contactor	No	.....	*	115 V.D.C. only
K-842	Accelerating Contactor Main Coil	No	.....	*	115 V.D.C. only
	Accelerating Contactor Holding Coil	No	.....	*	115 V.D.C. only
K-843	Accelerating Contactor Main Coil	No	.....	*	115 V.D.C. only
	Accelerating Contactor Holding Coil	No	.....	*	115 V.D.C. only
K-844	Overload Relay	No	*	.....	115 V.D.C. only

*To be filled in later.

TABLE OF TYPICAL DIAL AND TAP SETTINGS

FIG. 56

FREQ. KCS.	POWER RANGE	ANTENNA CONSTANTS	A	B	C	D	E	F	G	H	J	K	L
2000	High	C = 1000 R = 6.098	1	2081	18	26	053	059	Curr.	975	15	0	
	Low	1000 6.098	1	2081	18	26	019	....	Curr.	776	13	0	2000
3000	High	Inf. 29.18	4	3313	54	76	517	511	Volt	1409	26	080	4000
3500	High	Inf. 18.98	6	2313	68	87	661	652	Volt	1463	36	080	
		Type C											
4000	High	110 V.—500 W. Lamp	7	2235	78	08	483	473	Curr.	1017	93	600	
	Low	32 V.— 75 W. Lamp	7	2235	78	08	413	....	Curr.	590	85	600	
4500	High	110 V.—500 W. Lamp	8	2342	87	31	587	565	Curr.	977	100	700	
6000	High	110 V.—500 W. Lamp	4	3313	54	68	787	769	Curr.	1245	100	1100	
	Low	32 V.— 75 W. Lamp	4	3313	54	68	769	....	Curr.	785	81	1100	
7500	High	110 V. 500 W. Lamp	6	3282	73	85	909	889	Volt	1320	60	890	4000
	Low	32 V.— 75 W. Lamp	6	3282	73	85	897	....	Volt	878	39	890	18100
9050	High	110 V.—500 W. Lamp	8	2467	87	95	995	972	Volt	946	85	915	
	Low	32 V.— 75 W. Lamp	8	2467	87	95	983	....	Volt	654	70	915	
12000	High	110 V.—500 W. Lamp	4	3313	54	68	1099	1074	Volt	567	83	1205	
16000	High	110 V.—500 W. Lamp	7	2235	78	89	1191	1165	Volt	286	84	1384	
18100	High	110 V.—500 W. Lamp	8	2467	87	95	1233	1209	Curr.	1352	100	1120	

TABLE OF TYPICAL METER READINGS

FIG. 57

FREQ. KCS.	POWER RANGE	ANTENNA CONSTANTS	M ISG M. A.	O IP M. A.	1ST I. A. IP M. A.	2ND I. A. IG M. A.	2ND I. A. IP M. A.	P. A. IG M. A.	P. A. IP M. A.	VOLTAGES EP V.	VOLTAGES EG V.	VOLTAGES EF A. C. V.	ANTENNA I. INT. AMP.	ANTENNA I. EXT. AMP.	WATTS	GUAR. WATTS
2000	High	C = 1000 R = 6.098	14.5	49	38	25	61	71	350	2930	246	10	10.0	9.9	598	500
	Low	1000 6.098	14.5	49	53	33	150	...	...	3040	240	10	4.8	4.78	138	75
3000	High	Inf. 29.18	10.5	63	59	41	87	37	350	2910	242	10	4.2	4.7	645	500
3500	High	Inf. 18.98 Type C	9	63	58	44	88	27	350	2910	240	10	4.8	5.2	514	475
4000	High	110 V.—500 W. Lamp	9	74	66	27	48	52	350	2910	243	10	...	...	560	475
	Low	32 V.— 75 W. Lamp	9	75	88	22	125	..	...	3020	240	10	...	...	120	75
4500	High	110 V.—500 W. Lamp	9	72	67	28	79	59	350	2910	243	10	...	...	610	450
6000	High	110 V.—500 W. Lamp	10	62	63	24	72	37	350	2890	239	10	...	...	540	450
	Low	32 V.— 75 W. Lamp	10.5	62	79	25	125	..	...	3030	237	10	...	...	120	75
7500	High	110 V.—500 W. Lamp	9	73	76	39	96	34	350	2910	238	10	...	...	515	400
	Low	32 V.— 75 W. Lamp	9	74	88	30	125	..	...	3020	236	10	...	...	120	65
9050	High	110 V.—500 W. Lamp	9	71	70	29	87	31	350	2990	238	10	...	...	490	375
	Low	32 V.— 75 W. Lamp	9	72	80	28	125	..	...	3010	236	10	...	...	120	60
12000	High	110 V.—500 W. Lamp	10.5	63	60	20	68	38	350	2890	240	10	...	...	480	360
16000	High	110 V.—500 W. Lamp	9	72	65	26	83	47	350	2890	241	10	...	...	375	325
18100	High	110 V.—500 W. Lamp	8.5	72	60	24	90	44	350	2890	239	10	...	...	340	300

VIII. Vacuum Tube Data

A. General

8-1 ALL TUBES SUPPLIED WITH THE EQUIPMENT OR AS SPARES ON THE EQUIPMENT CONTRACT SHALL BE USED IN THE EQUIPMENT PRIOR TO EMPLOYMENT OF TUBES FROM GENERAL STOCK.

8-2 NOTE: The Type 860 tubes used in the master oscillator circuit of the transmitter unit should be of the anchored filament type, filament supported top and bottom in such a manner as to prevent contact variation and resultant variation in emitted signal. The use of an unanchored filament type tube may cause unstable operation of the Transmitter. The anchored type of filament may usually be recognized by the color of the filament turn which wraps around the center support. When the tube is operated at normal voltage, this turn on the anchored type will be cold whereas on the unanchored type this turn will glow.

8-3 NOTE: With respect to the Type 861 tube used in the power amplifier, it is desirable that the filament support rod be electrically connected to the filament. With tubes of Westinghouse manufacture having serial numbers 27200 or above, this connection is accomplished through resistors located in the base of the tube. Equivalent construction is employed also by other manufacturers.

8-4 In cases of severe overload resulting in the overheating of the tube, the electron emission may be very slight or may be reduced to a point where oscillations will not start. Unless the overload has liberated a large amount of gas, the activity of the filament can usually be restored by operating the tube at normal filament potential for ten minutes or longer with the plate potential off. This reactivating process can be accelerated by raising the filament potential to 12 volts but no higher. The useful life of all thoriated filament tubes is usually ended long before the filament burns out. If a tube loses its emission and cannot be reactivated within a reasonable length of time by the method described above, it should be replaced by a new tube.

8-5 When placing a thoriated tube in operation for the first time, it is desirable to operate the filament from five to ten minutes before plate power is applied. This serves a two-fold purpose. The hot filament tends to absorb any traces of gas that may be present in the tube and also permits the active material in the filament to diffuse to the surface of the filament.

8-6 Ordinary care in the handling and use of tubes will minimize accidental damage to the tubes. The tubes should be handled carefully and should not be allowed to snap into position when being placed in the socket. In all cases, regardless of the use to which the tubes are put, careful handling and conservative operation will be amply repaid by the longer and more uniform tube life which will be obtained.

8-7 A total of four vacuum tubes, three Type 860, and one Type 861, are used in the Radio Transmitter Unit.

8-8 The Type 860 tube is a four element or screen grid tube designed for use as an oscillator or power amplifier in transmitting circuits. It has a rated output of 75 watts at 2000 volts potential. The filament requires 3.25 amperes at 10 volts which should not fluctuate more than 5% from the rated value. Under normal operating conditions, the plate dissipation should never exceed 100 watts. The screen grid requires very little power for proper functioning and, therefore, its potential should be kept at as low a value as possible. The total dissipation on this grid should never exceed 10 watts.

8-9 The Type 861 tube is similar to the Type 860 except that it has a rated output of 500 watts at 3000 volts plate potential. Its filament requires 10 amperes at a potential of 11 volts which should not fluctuate more than 5% from the rated value. Its normal plate dissipation is 400 watts and its screen grid dissipation should never exceed 35 watts. Both the Type 860 and the Type 861 vacuum tubes are made with thoriated filaments which provide a large filament emission at low temperatures. In order to obtain satisfactory tube life these tubes should be handled with extreme care as they may be permanently injured if subjected to sudden shocks. They should never be operated above their rating and when not installed in the transmitter unit should always be

well secured and stowed in their original containers in an upright position.

8-10 A total of nine tubes are used in the modulator. These tubes are:

2—Type 803
3—Type 807
2—Type 6D6
1—Type 25Z5
1—Type 1616

8-11 Filament characteristics of the various tubes are given in the following table:

Tube	Functions	Fil. Voltage	Type of Cathode
Navy Type 803	Modulator	10.0 V.	Thoriated Filament
Navy Type 807	Amp. Voice Relay	6.3 V.	Indirectly Heated
Navy Type 6D6	Amplifier	6.3 V.	Indirectly Heated
Navy Type 25Z5	Compressor Limiter	25.0 V.	Indirectly Heated
Navy Type 1616	Modulator Limiter	2.5 V.	Oxide Coated Fil.

8-12 The tubes used in the modulator must be operated with an average filament voltage equal to the rated value. The variation of this voltage should be within plus or minus 5%. The use of a filament voltage less than that recommended will in time result in the loss of emission due to too low a rate of diffusion of active material to the filament surface. More than rated voltage will shorten the life of the tube by too rapid evaporation of the active material from the filament surface. During the stand-by period, the filament voltage should be maintained at the rated value.

8-13 The operating life of thoriated filament tubes (in this case the Navy Type 803), is ordinarily ended by decrease in electron emission. Decreased emission, however, may be caused by the accidental application of too high filament voltage, too high plate voltage, or operation at low filament voltage. If the over or under-voltage has not been continued for a long time, the activity of the filament can often be restored by operating the filament at its normal voltage for ten minutes or longer without plate or grid voltage. The reactivation process may be accelerated by raising the filament voltage to not higher than 20% above the normal value for a few minutes.

8-14 The useful life of all thoriated filament tubes is usually ended long before the filament burns out. If a tube loses its emission and cannot be reactivated within a reasonable length of time by the method described above, it should be replaced by a new tube.

8-15 All tubes, except the Type 6D6 and Type 25Z5 are provided with clamps which hold them positively from being vibrated or jarred out of the sockets. The Type 6D6 and Type 25Z5 tubes are provided with pressure type clamps. It is advisable not to remove these tubes any oftener than is necessary, which means normally not before their life is over. Frequent removals and replacements would result in scarring the base of the tube and possible looseness of the tube, thus making it easier for the tube to work its way out of the sockets. If, for any reason, a clamp is removed from the tube shelf, it should be replaced promptly.

8-16 The following tabulation compares the actual operating condition of the tubes as used in the Modulator Unit and Radio Transmitting Unit with the ratings listed in the Navy Tube Specifications. CAUTION: Except where indicating instruments are already incorporated in the equipment, operating personnel should not attempt to measure potentials in excess of 500 volts within the equipment due to hazards of life.

B.	TYPE 6D6		
		Max. Operating Value in Equip.	Max. Navy Rating RE-13A-600B
Ep	(DV)	250	250
Ip	(DMA)	8	10.9
Pp	(W)	2	....
Eg	(DV)	—7½	—3
Ig	(DMA)	0	0.5
Ig^2	(DMA)	3.5	3.5
Eg^2	(DV)	100	100
Eg^3	(DMA)	0	....
Eg^3	(DV)	0	....
Ef	(AV)	6.3	6.3
If	(AA)	0.3	0.325
Pi	(W)	2	....
Pg^3	(W)	0	....
Pg	(W)	0	....
C.	**TYPE 25Z5**		
Ep	(DV)	125	125
Ip	(DMA)	100	100
Ef	(AV)	25	25
If	(AA)	0.3	0.325

D. TYPE 807

	Max. Operating Value in Equip.	Max. Navy Rating RE-13A-600B
Ep (DV)	250	600
Ip (DMA)	120	120
Pp (W)	25	25
Eg (DV)	—16	....
Ig (DMA)	0	5
Ig^2 (AA)	16	....
Eg^2 (DV)	250	....
Ef (AV)	6.3	6.3
If (AA)	0.9	0.99
Pi (W)	35	60
Pg (W)	0	....

E. TYPE 1616

Ep (DV) (peak inverse)	7000	*5500
Ip (DMA) (average)	15	130
Ip (DMA) (maximum)	350	800
Ef (AV)	2.5	2.5
If (AA)	5.0	5.0

*Note: Permission has been obtained from the tube manufacturer (RCA Radiotron Corp.) to use this tube at 7000 volts inverse peak provided average plate current does not exceed 15 ma. and maximum plate does not exceed 350 ma.

F. TYPE 803

	Max. Operating Value in Equip.	*Max. Class B Rating
Ep (DV)	2000	2000
Ip (DMA)	160	160
Pp (W)	125	125
Eg (DV)	0	0
Ig (DMA)	25	....
Ig^2 (DMA)	35	....
Eg^2 (DV)	300	300
Ig^3 (DMA)	5	....
Eg^3 (DV)	40	40
Ef (AV)	10	10
If (AA)	5	5
Pi (W)	640	640
Pg^3 (W)	1	....
Pg (W)	5	(approx.) 5

*Note: Inasmuch as there is no Class B audio rating in RE-13A-600B, the rating is given as supplied by the tube manufacturer (Westinghouse Lamp Company).

G. MASTER OSCILLATOR TUBE, TYPE 860

	Full Load Operating Data	Maximum Rating Listed in RE-13A-600A	Amount by Which Rating is Exceeded
A.C. Filament Voltage	10 Volts	10 Volts	None
D.C. Plate Voltage	700 Volts	3000 Volts	None
D.C. Plate Current	60 Ma.	150 Ma.	None
D.C. Grid Voltage	—100 Volts	.... Volts	None
D.C. Grid Current	10 Ma.	40 Ma.	None
R.F. Grid Current	0.050 Amps.	10 Amps.	None
Plate Dissipation	20 Watts	100 Watts	None
Plate Power Input	42 Watts	300 Watts	None
Screen Input	6 Watts	10 Watts	None
Screen Voltage	300 Volts	... Volts	None

H. FIRST INTERMEDIATE AMPLIFIER TUBE, TYPE 860

A.C. Filament Voltage	10 Volts	10 Volts	None
D.C. Plate Voltage	2000 Volts	3000 Volts	None
D.C. Plate Current	88 Ma.	150 Ma.	None
D.C. Grid Voltage	—200 Volts	... Volts	None
D.C. Grid Current	15 Ma.	40 Ma.	None
R.F. Grid Current	0.10 Amp.	10 Amp.	None
Plate Dissipation	75 Watts	100 Watts	None
Plate Power Input	176 Watts	300 Watts	None
Screen Input	6 Watts	10 Watts	None
Screen Voltage	275 Volts	... Volts	None

I. SECOND INTERMEDIATE AMPLIFIER TUBE, TYPE 860

	Full Load Operating Data	Maximum Rating Listed in RE-13A-600A	Amount by Which Rating is Exceeded
A.C. Filament Voltage	10 Volts	10 Volts	None
D.C. Plate Voltage	2000 Volts	3000 Volts	None
D.C. Plate Current	150 Ma.	150 Ma.	None
D.C. Grid Voltage	—200 Volts	.... Volts	None
D.C. Grid Current	40 Ma.	40 Ma.	None
R.F. Grid Current	0.250 Amps.	10 Amps.	None
Plate Dissipation	100 Watts	100 Watts	None
Plate Power Input	300 Watts	300 Watts	None
Screen Input	8 Watts	10 Watts	None
Screen Voltage	250 Volts	... Volts	None

J. POWER AMPLIFIER TUBE, TYPE 861

A.C. Filament Voltage	11 Volts	11 Volts	None
D.C. Plate Voltage	3000 Volts	3500 Volts	None
D.C. Plate Current	350 Ma.	350 Ma.	None
D.C. Grid Voltage	—250 Volts	... Volts	None
D.C. Grid Current	75 Ma.	75 Ma.	None
R.F. Grid Current	1.5 Amp.	10 Amp.	None
Plate Dissipation	350 Watts	400 Watts	None
Plate Power Input	1050 Watts	1200 Watts	None
Screen Input	20 Watts	35 Watts	None
Screen Voltage	460 Volts	... Volts	None